

Course Correction: China is Going Carbon Neutral

Luke O'Callaghan-White



Abstract

In a video-link address to the UN General Assembly in New York on 22 September, Chinese President, Xi Jinping announced that China will aim to hit peak greenhouse gas emissions before 2030 and seek to become carbon neutral by 2060. Given the negligible progress there has been in the international climate agenda outside of the EU recently, China's ambitious pledge came as a genuine surprise.

Four factors seem to underlie the Chinese commitment to be carbon neutral by 2060: geostrategic considerations, energy security concerns, rapid levels of urbanisation in China, and the exponential growth of the Chinese middle-class.

There will be significant consequences to a carbon-neutral China. By reaching net-zero emissions by 2060, China will play a constructive role in the effort to limit global temperatures. It will also lead to economic growth. China's net zero commitment could also cause international financial markets to shift exponentially towards greener solutions. This would have serious implications for the competitiveness of many European firms in the hydrogen sector and may challenge the viability of the European Commission's 'Next Generation EU' Recovery plan. By the mid-21st Century, the international economic and geopolitical landscape may be changed profoundly by China's proposed climate and energy-system transformation.

Introduction

This paper examines the driving forces behind - and the implications of - China's pledge to become carbon neutral by 2060 and to peak emissions by 2030. It begins by explaining why this net-zero target is so significant for the state of global warming and international climate action. It then outlines China's current energy mix and examines the non-carbon pathways which China has recently pursued and which it will continue to develop to meet its climate and energy targets. A brief analysis follows as to whether these commitments are realisable.

The second part of this paper examines the forces which are driving this major change in the Chinese energy and climate agenda. It argues that there are foreign policy and domestic policy concerns which underpin China's pledge to become a net-zero state by 2060.

The third and final part of this paper assesses the implications of a rapidly decarbonised and net-zero China. It argues that it is likely that in becoming carbon neutral, China will see an increase in its GDP levels. The potential for economic growth is particularly relevant during a period of pronounced global economic contraction following the COVID-19 pandemic. It explores experts' predictions that China will strengthen its dominance in the field of renewable energy technologies and that as China scales up renewable energy capabilities that it will develop hegemony in important emerging markets such as hydrogen. It concludes by analysing the implications of this both for China and the EU, which is at present a market competitor in hydrogen sector.

Section 1 – China's Pathway to Net-Zero Emissions

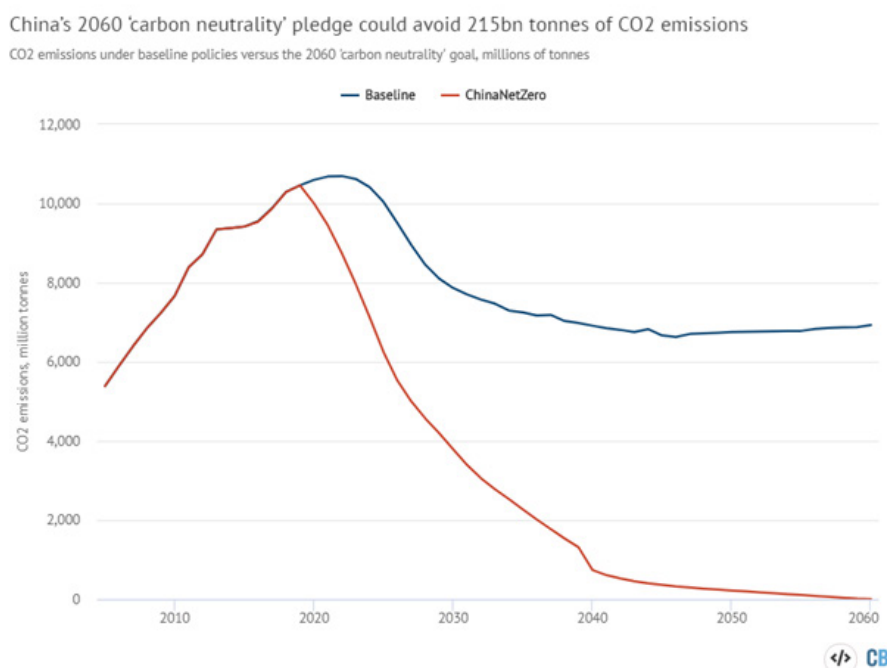
Why is China's Net Zero Target Important?

On 22 September 2020, Chinese President, Xi Jinping announced that China will aim to hit peak greenhouse gas emissions before 2030 and seek to become carbon neutral by 2060. China has set out a long-term trajectory for decarbonisation, with specific details and evidence of concrete implementation yet to be unveiled in its upcoming *Five-Year Plan*.¹ This announcement places climate action at the core of China's economic and geopolitical agenda.

¹ Harvey, F. 'China Pledges to Become Carbon Neutral Before 2060', *The Guardian*, 22 September 2020: <https://www.theguardian.com/environment/2020/sep/22/china-pledges-to-reach-carbon-neutrality-before-2060>.

This decision to commit to a carbon neutral future has significant and far reaching implications for oil demand and renewable energy markets; for the Chinese and world economy; but most discernibly for achieving the targets of the Paris Climate Agreement and limiting global temperature increase. Various climate models forecast that this pledge could avoid 0.20C – 0.30C of global warming. This would make a profound contribution to the effort to keep global temperatures well below 20C above pre-industrial levels. Figure 1 shows that a carbon-neutral China by 2060 would avoid the release of 215 billion tonnes of CO₂.²

Figure 1³



China's Energy Mix

China is an energy behemoth. It is the world's biggest source of carbon dioxide - responsible for around 28% of global emissions. China is also the world's largest green energy market. It produces more than 70% of the world's solar panels, dominates the supply chain for lithium-ion batteries, and is home to more than 45% of global renewable investment. The 2019 International Renewable Energy Agency's (IRENA) Report on 'The Geopolitics of the Energy Transformation', notes that no country is in a better position to become a renewable energy superpower than China.⁴

China is the world's largest consumer of energy. Over the last half century, as it experienced unparalleled levels of economic growth, China's boom in its manufacturing-based economy has primarily been fuelled by coal.⁵ The industrial sector continues to account for roughly two thirds of China's total energy consumption. Its energy mix is dominated by coal and oil, but lately China's energy needs are increasingly met by renewables, natural gas, nuclear power, and electricity.⁶

² Pollitt, H. 'Analysis: Going Carbon Neutral by 2060 "Will Make China Richer"', Carbon Brief, 24 September 2020: <https://www.carbonbrief.org/analysis-going-carbon-neutral-by-2060-will-make-china-richer>.

³ Modelled CO₂ emissions in China under existing policies and technology trends (baseline, blue line) versus a pathway to net-zero by 2060 (China NetZero, red), millions of tonnes of CO₂. Source: Cambridge Econometrics modelling. Chart by Carbon Brief, guest post by Pollitt, H. using Highcharts, 24 September 2020: <https://www.carbonbrief.org/analysis-going-carbon-neutral-by-2060-will-make-china-richer>.

⁴ International Renewable Energy Agency (2019) 'Global Commission on the Geopolitics of the Energy Transition', A New World: The Geopolitics of the Energy Transition, https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/Global_commission_geopolitics_new_world_2019.pdf.

⁵ China Power Team. "How Is China's Energy Footprint Changing?" China Power. 15 February 2016. Updated 26 August 2020: <https://chinapower.csis.org/energy-footprint/>.

⁶ <https://www.iea.org/countries/china>.

Five-Year Plans: Mapping Out Decarbonisation

Since 1953, social and economic development initiatives in China have been issued through Five-Year Plans. In the 13th Five-Year Plan 2016-2020, President Xi Jinping pledged to “advance the energy revolution” and to “build a modern energy system that is clean, low-carbon, safe and efficient”⁷ The approach to sustainable energy systems in China over the last four-and-a-half years has focussed on decarbonisation, increased renewable energy adoption and development of gas and nuclear energy.⁸

China is now finalising its 2021-2025 Five-Year Plan which analysts anticipate will include new climate and energy objectives, and provide a clearer and more detailed pathway to reach the 2030 and 2060 targets. The upcoming Plan is likely to be influenced by economic stability concerns which arise from the COVID-19 pandemic. In March 2020, following the coronavirus outbreak, China released a \$7 trillion stimulus package, which remains committed to accelerated penetration of renewable energy systems and electric vehicles.⁹ However, as Climate Action Tracker notes, “recovery activities remain carbon-intensive and require high energy demand from a system run primarily on fossil fuels.”¹⁰

While the 5-Year Plans lay out China’s energy and climate plans, the pathway to a net-zero future remains an enormous task to complete. The energy transition to cap emissions by 2030 and to be at net-zero emissions by 2060 requires a profound transformation at an unprecedented scale and speed. However, Beijing’s continued support of the coal industry is stymying this transformation. China burns 25% of the world’s coal and is home to 50% of the industry’s workforce. The March 2020, COVID-19 stimulus package \$7 trillion includes spending plans for several new coal-fired plants, while Chinese banks continue to finance dozens of coal plants in other Asian countries through the Belt and Road development initiative.¹¹ These spending programmes on coal-fired developments are irreconcilable with the commitment of carbon neutrality and renewables mentioned above.

China’s commitment to peak emissions by around 2030 is an element of its Nationally Determined Contribution (NDC). An important part of the Paris Agreement, NDCs outline the post-2020 long-term climate actions taken by each signatory to the accord. Meeting the 2030 targets will require “building an additional 800-1000 gigawatts of non-fossil energy, roughly equivalent to the entire US electricity system.”¹² Today, fossil fuels still account for about 85% of China’s energy mix, and renewable energy makes up 15%. It is likely that these proportions would need to flip by 2060 to achieve carbon neutrality.¹³ Achieving the 2060 target will require a complete decarbonisation of China’s electricity supply, more than 60% of which still comes from burning coal.¹⁴ To succeed in this endeavour, the government would need to end its funding for coal and deepen its commitment to onloading renewable energy, increase its energy storage capabilities, and fund developments in green technologies at an unprecedented scale.

While China’s power generation is still heavily reliant on fossil sources, a recent major study published in Nature Communications shows that China could generate more than 60% of its electricity from “non-fossil” sources by 2030 – including wind, solar, hydro and nuclear – at a cost that is around 10% lower than under business-as-usual and still meet rising demand. This suggests China could raise its target to get 50% of its electricity from non-fossil sources by 2030,

7 Compilation and Translation Bureau, Central Committee of the Communist Party of China (2016) ‘The 13th Five-Year Plan for Economic and Social Development of The People’s Republic of China: 2016-2020’, https://en.ndrc.gov.cn/policyrelease_8233/201612/P020191101482242850325.pdf

8 Colle, S. ‘With a Promise of Bluer Skies, How Will China Power its Energy Revolution?’ EY, 18 June 2019: https://www.ey.com/en_gl/power-utilities/with-a-promise-of-bluer-skies-how-will-china-power-its-energy-revolution

9 <https://climateactiontracker.org/countries/china/>

10 <https://climateactiontracker.org/countries/china>

11 Temple, J. ‘If China Plans to Go Carbon Neutral by 2060, Why is it Building So Many Coal Plants?’ MIT Technology Review, 23 September 2020: <https://www.technologyreview.com/2020/09/23/1008786/china-carbon-neutral-coal-plants-un/>

12 Finamore, B. (2018) ‘Will China Save the Planet?’ Polity Press: Cambridge.

13 Ambrose, J. ‘China’s Carbon Pledge Will Require Complete Inversion of Existing System’, the Guardian, 27 September 2020: <https://www.theguardian.com/environment/2020/sep/27/china-carbon-pledge-put-energy-system-reverse-wind-solar>.

14 ‘China Aims to Cut its Net Carbon-Dioxide Emissions to Zero by 2060: Achieving this Will Not Be Easy’ the Economist, 24 September 2020: <https://www.economist.com/china/2020/09/24/china-aims-to-cut-its-net-carbon-dioxide-emissions-to-zero-by-2060>.

while saving money.¹⁵

While some analysts remain sceptical that China can meet these ambitious targets it has set, it is worth remembering that China has undergone transformational change in short periods of time before. China went from a low-income country to an upper-middle income country in roughly 30 years. In the 40 years between 1978 and 2018, China doubled its GDP, on average, every eight years and this economic growth has raised an estimated 800 million people out of poverty.¹⁶ It is also worth noting that China has a number of significant incentives to implement an expeditious but thorough decarbonisation agenda. It is to the assessment of these factors, that the paper now turns.

Section II- Factors Influencing China's Decision

Four factors seem to underlie the Chinese commitment to be carbon neutral by 2060: geostrategic considerations, energy security concerns, rapid levels of urbanisation in China, and the exponential growth of the Chinese middle-class.

Geostrategic Factors

At the 2009 Copenhagen UN Climate Summit, China refused to accept any binding international limits on its greenhouse gas emissions. Experts remarked that, at the time, a global climate agreement seemed completely out of reach.¹⁷ However, just seven years later, in September 2016, China formally joined the Paris Climate Agreement – the world's first comprehensive climate accord which seeks to keep global temperatures well below 20C. China was just the 24th country to ratify the agreement. At the time, President Xi received praise for his "climate leadership" and his "far-sighted, bold and ambitious" agenda from then-US President Barack Obama and then-UN Secretary General Ban Ki-moon respectively.¹⁸ The US and China ratified the Paris Agreement together and this gesture gave momentum to the agenda to transition to a low carbon future and influenced the speed with which the Agreement entered force throughout the world.¹⁹ A climate partnership developed between the US and China during President Obama's tenure. Between 2014 and 2016 the two countries worked together to: advance carbon capture use and storage projects; promote trade in green goods; and expand joint clean energy research and development, to name but a few areas of collaboration.²⁰

US-Chinese bilateral climate relations have deteriorated seriously since the election of Donald Trump in 2016. President Trump has pulled the US out of the Paris Climate Agreement and has stated that he believes that climate change is "a hoax"²¹ and that, "the concept of global warming was created by and for the Chinese in order to make US manufacturing non-competitive."²² The US is now the only major polluting country which has yet to set a target to end its contribution to the climate crisis.

President Xi Jinping sent a pointed geopolitical message to the United States by outlining his country's ambitious climate agenda in advance of the upcoming US Presidential election. It has been argued that by outlining the net-zero targets before the US election, China is seeking to offset any anticipated scaled-up U.S. pressure and demands on climate action if Democratic nominee Joe Biden wins in November 2020.²³

15 He, G., Lin, J., Sifuentes, F. et al. (2020) 'Rapid Cost Decrease of Renewables and Storage Accelerates the Decarbonization of China's Power System. *Nat Communications* 11:2486.

16 'China's Economic Rise: History, Trends, Challenges, Implications for the United States', Congressional Research Service Report, 25 June 2019: <https://fas.org/sgp/crs/row/RL33534.pdf>.

17 Finamore, B. (2018) 'Will China Save the Planet?' Polity Press: Cambridge.

18 'Paris Climate Deal: US and China Formally Join Pact' BBC News, 3 September 2016: <https://www.bbc.com/news/world-asia-china-37265541>.

19 Finamore, B. (2018) 'Will China Save the Planet?' Polity Press: Cambridge

20 <https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c>

21 <https://twitter.com/realDonaldTrump/status/427226424987385856>

22 <https://twitter.com/realdonaldtrump/status/265895292191248385?lang=en>

23 China Announced New Climate Goals. But it Can't Quit Coal Just Yet', the Washington Post, 29 September 2020: <https://www.washingtonpost.com/politics/2020/09/29/china-announced-new-climate-goals-it-cant-quit-coal-just-yet/>.

China's commitment to net-zero emissions by 2060 comes during a time when climate multilateralism is under serious duress and when the COVID-19 pandemic has forced the cancellation of COP26 until 2021. Except for the EU's Green Deal, little by way of increased international climate ambition had been expected. China's announcement gives the nation a pivotal role in the upcoming UN climate discussions and could persuade other nations to follow its low-carbon trajectory.²⁴ This 2060 pledge is an opportunity which neatly aligns with Chinese commitment to greater energy security, as will be discussed in the next section, but it is also an opportunity for China to claim to be a constructive actor in the multilateral world order. China is still in the process of establishing itself as a 'great power'.

Taking a leadership role in international climate action efforts may deliver geostrategic and reputational benefits to China as it navigates a trade war with the US, and faces international sanctions in response to its mass internment of Muslim Uyghurs in Xinjiang Province, and widespread repudiation for the promulgation of a robust state security law in Hong Kong.

China's geopolitical standing in the world will grow as it continues to invest in renewable technologies and build up clean energy capacities. By contrast, IRENA forecasts that countries which continue to rely heavily on fossil fuel exports and do not adapt to the energy transition will face risks and lose geopolitical influence.²⁵ It is likely, therefore, that geostrategic considerations can help to explain why China has pledged to reach net-zero emissions by 2060.

Geostrategic Factors

China's energy security strategy and its commitment to decarbonise its energy system complement one another. As a country increases the amount of renewable energy that can be produced domestically, its levels of energy security increase concomitantly.²⁶

The shock of the COVID-19 pandemic has had a major impact on the energy sector. Around the world, energy systems have come under pressure to provide electricity, home heating, medical services, and to distribute supplies.²⁷ During stringent lockdowns, demand from the manufacturing sector fell considerably, but a recent IEA report notes that China's energy system performed well under these exceptional circumstances, which indicates robust energy security.²⁸

Many countries are re-evaluating their energy systems and looking to improve their security of energy supply. While it managed the lockdowns during the initial outbreak of the coronavirus, improving its energy security is a fundamental objective of the Chinese government.²⁹

The COVID-19 pandemic has exposed the fragility of international supply chains. China faces considerable threats to its energy security. Much of China's foreign energy supply comes from politically unstable regions and must travel through narrow straits and contested waterways before reaching China.³⁰ It is a net importer of oil, half of which comes from the Middle East. Given the political instability in that region, this represents an important energy security concern for China³¹.

24 China's Carbon-Neutral Target for 2060: What Does it Mean for Global Climate Action? edie, 23 September 2020: <https://www.edie.net/news/9/China-s-carbon-neutral-target-for-2060--What-does-it-mean-for-global-climate-action-/>.

25 International Renewable Energy Agency (2019) 'Global Commission on the Geopolitics of the Energy Transition', A New World: The Geopolitics of the Energy Transition, https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/Global_commission_geopolitics_new_world_2019.pdf.

26 Ibid

27 'Post Covid-19, Further Reform is Necessary to Accelerate China's Clean Energy Future' International Energy Agency, 22 July 2020: <https://www.iea.org/articles/post-covid-19-further-reform-is-necessary-to-accelerate-china-s-clean-energy-future>.

28 Ibid.

29 Au, L. and Wilhelm, B. (2020) 'Xi's Climate Pledge is Really About China's Energy Security', World Politics Review, <https://www.worldpoliticsreview.com/trend-lines/29097/xi-s-climate-pledge-is-really-about-china-s-energy-security>

30 China Power Team. "How Is China's Energy Footprint Changing?" China Power. 15 February 2016. Updated 26 August 2020: <https://chinapower.csis.org/energy-footprint/>

31 Ibid

While China produces more coal than any other country, it cannot meet demand without imports. It also relies heavily on gas imports in the form of liquified natural gas (LNG), with 47% coming from Australia, and is expected to be the world's largest LNG importer by 2022.³² Chinese-Australian relations have deteriorated significantly in 2020 which could threaten LNG trade. By producing more of its own clean energy, China will reduce its reliance on fuel imports and the risks of energy disruption which could compromise its economic and geopolitical agenda.

Urbanisation and Air Pollution in Chinese Cities

One of the principle drivers of greenhouse gas emissions in China is the intense urbanisation that has taken place in recent years. By 2010, roughly 700 million of the Chinese population were city dwellers and it is expected that an additional 280 million rural people will move to urban centres in the coming years.³³ This will lead to further intensified industrial development, increased consumption, and a growth in the number of vehicles on the roads - all major sources of emissions

Smog and environmental degradation are important political and social issues in China. It is estimated that air pollution is responsible for more than 1 million premature deaths in China each year. Beijing is surrounded by the country's coal and heavy industry heartland. The six provinces around the capital burn roughly 30% of China's total coal, which is more than the US and EU combined.³⁴ As a consequence, Beijing's air is heavily polluted. The rapid urban industrialisation of the recent decades has come at a serious environmental, social and political cost.

Chinese citizens have participated in protests across numerous major cities to express their dissatisfaction with poor air quality. In recent years, protesters have taken to the streets of Chengdu, Sichuan, Wuhan, and Jiangsu. Such organised public displays of outrage and discontent with the central government are uncommon in China which has a history of clamping down on protest movements with alacrity and force.³⁵

Environmental concerns, however, are one of the leading causes of protests in China.³⁶ In 2017, following a series of anti-pollution rallies, President Xi vowed to clean up the nation's air and water quality and to make China an "ecological civilisation".³⁷ Despite some concrete efforts from the Chinese government to curb coal burning, coal consumption actually increased in 2017 and 2018, after having declined in each of the previous three years, which means that coal-powered industries will continue to be a major source of pollution and carbon emissions in China.³⁸

During the first four months of 2020, air pollution levels dropped by over 25% throughout China. This was an unprecedented decrease.³⁹ During the first wave of the coronavirus pandemic beginning in February 2020, coal-fired power plants and industrial facilities limited their output to allow employees in high-risk areas to stay home. The increase in air quality is unlikely to last as Chinese industry begins to ramp up again and this may create political pressure for President Xi if citizens are forced to endure smog-filled skies once more. The Government's pledge to reach peak emissions by 2030 and reach carbon neutrality by 2060 may therefore serve as a signal to the Chinese people that it is serious about taking sustained action to improve air quality in its cities.

32 Ibid.

33 Gabbatiss, J. 'China's Emissions "Could Peak 10 Years Earlier than Paris Climate Pledge"', Carbon Brief, 29 July 2020: <https://www.carbonbrief.org/chinas-emissions-could-peak-10-years-earlier-than-paris-climate-pledge>.

34 Myllyvirta, L. 'Air Pollution Around Beijing Rebounds as Coal Consumption Rises by 13%' Unearthed: Greenpeace, 22 May 2019: <https://unearthed.greenpeace.org/2019/05/22/air-pollution-china-beijing-coal-2018/>.

35 Griffiths, J. 'China Has Made Major Progress on Air Pollution. Wuhan Protests Show There's Still a Long Way to Go' CNN World, 11 July 2019: <https://edition.cnn.com/2019/07/10/asia/china-wuhan-pollution-problems-intl-hnk/index.html>.

36 Standaert, M. 'As It Looks to Go Green, China Keeps a Tight Lid on Dissent' Yale Environment 360, 2 November 2017: <https://e360.yale.edu/features/as-it-looks-to-go-green-china-keeps-a-tight-lid-on-dissent>.

37 Ibid.

38 China Power Team, 'Is Air Quality in China a Social Problem?' China Power, 15 February 2016: <https://chinapower.csis.org/air-quality/>.

39 Sommer, L. 'Why China's Air Has Been Cleaner During the Coronavirus Outbreak', National Public Radio, 4 March 2020: <https://www.npr.org/sections/goatsandsoda/2020/03/04/811019032/why-chinas-air-has-been-cleaner-during-the-coronavirus-outbreak?t=1602856982133>

China's Growing Middle-Class

One related but important consideration is the exponential growth of the Chinese middle-class. In his address to the IIEA in June 2019, Dr Kerry Brown remarked that the Chinese middle-class - which currently stands at 300-400 million people, but will rise to 700 million in the next few years - will decide China's fate. Research from the Pew Research Center shows that as economically developing countries grow prosperous, the values of the middle classes appear to change.⁴⁰ The data show that they are more concerned with global warming and pollution in their own country than other class groups.

As hundreds of millions of Chinese people have been lifted from poverty, their expectations and attitudes begin to change such that heavy industrial development at the expense of intense smog and poor air quality is no longer a tenable bargain. The Chinese middle-class is increasingly concerned with the degradation of their local environment and the threat this poses to their health and living standards.⁴¹ Dr Brown stated that this emerging middle-class in China has much greater agency than at any time before, and that Xi Jinping Leadership is about creating a new social contract with this most salient political constituency.⁴²

In recent years, many elements of the Chinese environmental agenda have been aimed at making immediate and discernible progress, thus letting the air out of potentially explosive public outbursts and demonstrations.⁴³ Therefore, in order to maintain the support of the massive middle-class, the Chinese government is pursuing robust environmental and climate action in the form of pledging to be a net-zero emitter in the next four decades.

Section III – Consequences of Climate-Neutral China

The Future Chinese Economy

The consequences of a net-zero China are challenging to overstate. As mentioned earlier, it would have a significant impact in reducing global temperature increase. It is not feasible that the global response to climate change, set out in the Paris Agreement, will be effective without sustained and ambitious contributions from China.

As a global power, China's pledge to become net zero may also influence other Asian countries or significant trading partners to follow suit and reappraise their energy and climate targets. A carbon neutral China will strengthen the global response to keep global temperatures well below 2°C and have significant environmental and biodiversity impacts. However, this outcome will have profound impact on China's economy and its market competitiveness.

Forecasting conducted by Cambridge Econometrics shows that China's move to carbon neutrality will raise its GDP by up to 5% by the end of this decade, with a continued positive impact due to reduced fossil-fuel imports up to 2060.⁴⁴ As China's energy sector decarbonises, levels of pollution will decrease. Given that the World Bank estimates that pollution has led to the loss of 6% of GDP, China's transition to net zero emissions will have a significantly positive impact on its economic power.⁴⁵

International 'Green' Energy Markets

40 'The Global Middle Class', Pew Research Centre, 12 February 2009: <https://www.pewresearch.org/global/2009/02/12/the-global-middle-class/>.

41 Ekman, A. (2015) 'China's Emerging Middle Class: What Political Impact' Centre for Asian Studies, *Asia Visions*: 76.

42 Brown, K. (2018) 'The World According to Xi: Everything You Need to Know About the New China' Bloomsbury: London.

43 Standaert, M. 'As It Looks to Go Green, China Keeps a Tight Lid on Dissent' *Yale Environment* 360, 2 November 2017: <https://e360.yale.edu/features/as-it-looks-to-go-green-china-keeps-a-tight-lid-on-dissent>.

44 Pollitt, H. 'Analysis: Going Carbon Neutral by 2060 "Will Make China Richer"', *Carbon Brief*, 24 September 2020: <https://www.carbonbrief.org/analysis-going-carbon-neutral-by-2060-will-make-china-richer>.

45 <https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx>.

China's scope of influence in world markets should not be ignored. Its net zero commitment could also cause financial markets to shift exponentially towards greener solutions.⁴⁶ China has already developed significant comparative advantages in the field of renewable energy technologies. It is the biggest location for renewable energy investment, accounting for more than 45% of the global total in 2017. It is home to two-thirds of the world's solar-production capacity and is the largest producer of wind turbines.⁴⁷

There has been a steady decline in the costs of renewable energy technologies. Over the last ten years, the average cost of electricity from solar PV energy has fallen by 73%,⁴⁸ and the cost of solar panels and batteries have declined by 85%.⁴⁹ This steep and continued reduction in such costs is expected to continue and accelerate, and will be integral both in assisting China's decarbonisation pathway but also in improving the market position of wind and solar in the developing world.⁵⁰ Its technological expertise in renewables has established it as a leading exporter of clean energy technology, creating a balance of trade advantage which lends impetus to the country's economic growth.

The development of renewable hydrogen will likely play a major role in the energy system of a net-zero China. It is also seen, by the European Union as essential in the context of reaching net-zero emissions by 2050. Hydrogen facilitates the transportation of electricity to sectors for which decarbonisation is otherwise difficult – such as industry, buildings and transport, as well as in niche applications such as remote locations.⁵¹

The European Commission's economic recovery plan 'Next Generation EU' highlights hydrogen as an investment priority to boost economic growth and resilience, create local jobs and consolidate the EU's global leadership.⁵²

At present, Europe has a relative advantage in necessary technologies, however given the size of the Chinese market and the benefits that accrue from its economies of scale, the European companies may lose out to a China committed to carbon neutrality.⁵³ As costs fall and new technologies become available, the hydrogen economy will grow. China's potential dominance in the hydrogen sector could have serious implications for the competitiveness of the European green economy.

Conclusion

President Xi Jinping's surprise announcement to the UN General Assembly in September 2020 reflects a shift in China's strategic agenda. China is an energy superpower and its decision to transform its energy system to one which is carbon neutral will have considerable positive externalities. Peaking emissions by 2030 and reaching net-zero emissions by 2060 would make a profound contribution to the effort to keep global temperatures well below 2°C above pre-industrial levels.

The commitment to become climate neutral will deliver geopolitical and reputational benefits at a time when China faces many pressing challenges. Several important domestic political issues have also contributed to China's 2060

46 China's Carbon-Neutral Target for 2060: What Does it Mean for Global Climate Action? edie, 23 September 2020: <https://www.edie.net/news/9/China-s-carbon-neutral-target-for-2060--What-does-it-mean-for-global-climate-action/>

47 <https://www.iea.org/countries/china>

48 International Renewable Energy Agency (2019) 'Global Commission on the Geopolitics of the Energy Transition', A New World: The Geopolitics of the Energy Transition, https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/Global_commission_geopolitics_new_world_2019.pdf.

49 America's Domination of Oil and Gas Will Not Cow China', the Economist, 17 September 2020: <https://www.economist.com/briefing/2020/09/17/americas-domination-of-oil-and-gas-will-not-cow-china>.

50 Hove, A. (2020) 'Current Direction for Renewable Energy in China' Oxford Energy Comment: The Oxford Institute for Energy Studies, <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/06/Current-direction-for-renewable-energy-in-China.pdf>.

51 <https://www.irena.org/energytransition/Power-Sector-Transformation/Hydrogen-from-Renewable-Power#:~:text=At%20present%2C%20roughly%2095%25%20of,and%20oxygen%20in%20an%20electrolyser.>

52 https://ec.europa.eu/commission/presscorner/detail/en/FS_20_1296

53 Janssen, D. 'Europe, China Battle for Global Supremacy on Electrolyser Manufacturing', Euractiv, 28 August 2020: <https://www.euractiv.com/section/energy/news/europe-china-battle-for-global-supremacy-on-electrolyser-manufacturing/>.

commitments. By pursuing a pathway towards net-zero emissions pathway China's economy will grow. Immediate and sustained investment in renewable energy systems will hasten this growth.

China has developed significant comparative advantages in the field of renewable energy technologies. Its net zero commitment could also cause financial markets to shift exponentially towards greener solutions. This would have serious implications for the competitiveness of many European firms in the hydrogen sector.

A carbon-neutral China will have far-reaching implications for Chinese society, its economy, and the international geopolitical order.

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The Institute of International and European Affairs,

8 North Great Georges Street, Dublin 1, Ireland

T: +353-1-8746756 F: +353-1-8786880

E: reception@iiea.com W: www.iiea.com