CCAG
Climate Crisis Advisory Group

China

CCAG COUNTRY REPORT

Looking to the future in China

SHANGHAI BUND, SHANGHAI, CHINA. IMAGE: EDWARD HE

COVER IMAGE: SHANGHAI INTERCHANGE, SHANGHAI, CHINA. IMAGE: DENYS NEVOZHAI

China has demonstrated a commitment to emissions reductions via its nationally determined contributions (NDCs), as well as wider policy efforts to support a transition away from fossil fuels towards an economy based on renewable energy – but momentum must be maintained.[1]

The recent emphasis on national energy security as a priority, and the inclusion of new fossil fuel exploitation as a part of that, shows a shift of focus. Momentum gained in the energy transition could be lost. The world needs China to press on with its best emissions reduction efforts – and to step them up, not down.

Although China remains, in absolute volume, as dependent on coal for electricity and industrial production as it has ever been, there has been reason to anticipate a transition phase when emissions stop rising, and rapid reductions to follow in the next few years. The grounds for optimism lie in the rapid and high-volume take-up or planned take-up of renewable energy from a range of sources: hydro, solar, wind and nuclear. CO_2 emissions rose very rapidly between 2000 and 2010 (see figure 1a), but then levelled off (see figure 1b). Notably, electricity demand doubled between 2010 and 2020 (see figure 2), with almost half of new supplies being met without additional coal.[2]

At the October 2022 meeting of the Communist Party of China (CPC) President Xi spoke about many areas of policy including climate change and energy security.[3] On climate change, Xi re-emphasised a target he proposed to the 75th UN General Assembly in September 2020, promising China will 'strive to achieve' its carbon emissions peak by 2030, and carbon neutrality by 2060.

Xi's announcement was considered, in September 2020, as a positive outcome for global efforts on climate change. Domestically, it generated major reactions with all levels of government and their agencies, as well as all large SOEs (state-owned enterprises), immediately responding with enthusiasm and investment of resources. Many coal mines in China were shut down on the strength of the policy.

In summer 2021, coal prices soared to an all-time high. In addition, many businesses in China suffered from regular power outages, imposed to control energy use in order to meet carbon emission targets. These campaign-style responses, later considered to be extreme, were cooled off by China's central government in efforts to balance economic activity and climate targets.

In his keynote speech in October 2022, President Xi called for "working actively and prudently toward the goals of reaching peak carbon emissions and carbon neutrality". This sets the base tone for climate policy in the next five to ten years. It is meant to balance the economic growth and carbon emissions reduction, but definitely implies a lowering of strategic priority for climate change mitigation measures. This is born out by the detail of his speech (see China's energy transition, page 4).

Even before the change of emphasis captured in President Xi's speech, China's commitment to emissions reduction – and to the Paris Agreement process – was considered to fall short of what the world needs.[4]

FIGURE 1A

CHINA'S CO_2 EMISSIONS 1900 TO PRESENT

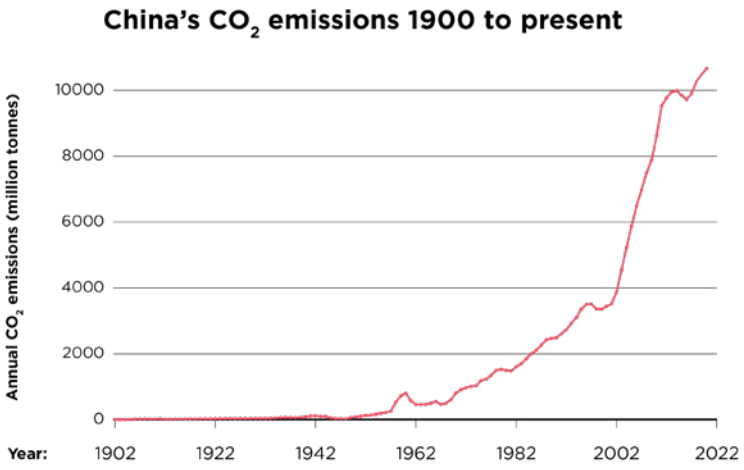


FIGURE 1B

CHINA'S CO_2 EMISSIONS 2000 TO PRESENT

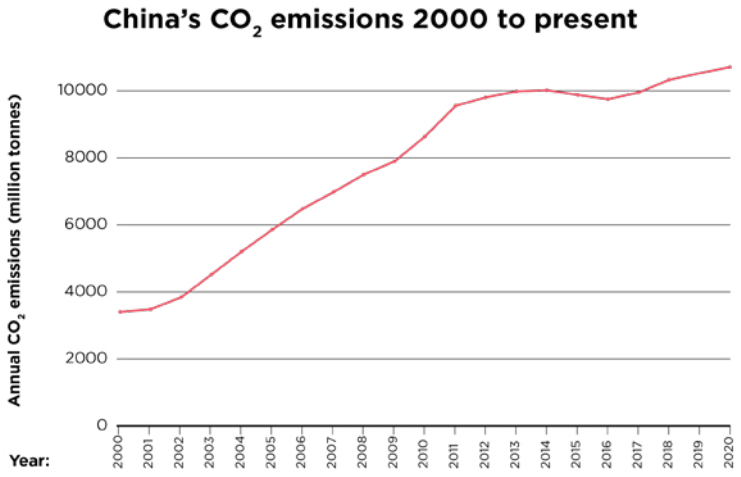


FIGURE 2

ANNUAL DEMAND FOR ELECTRICITY IN CHINA WITH ANNUAL SHIFT IN COAL CONSUMPTION 2000 TO PRESENT

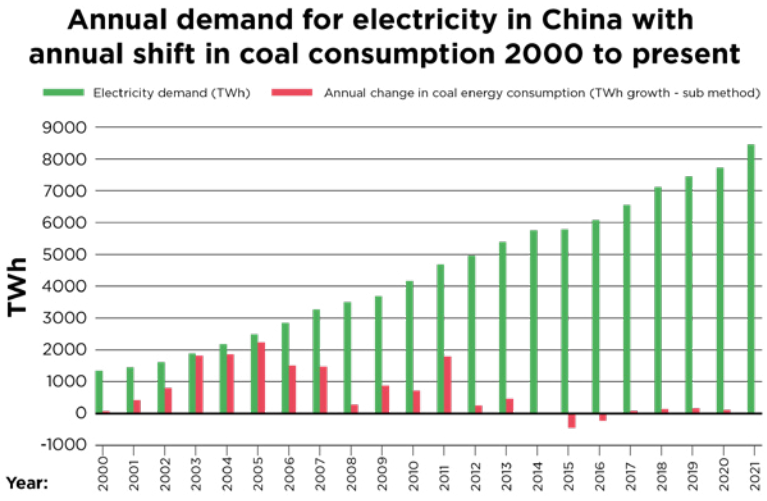


Figure 1a source:
Our World in Data

Figure 1b source:
Our World in Data

Figure 2 source:
Our World in Data; World Bank

CHINA'S ENERGY TRANSITION

President Xi[5] confirmed China "will advance initiatives to reach peak carbon emissions in a well-planned and phased way based on the country's energy and resources endowment".

He stressed the principle of "building the new before discarding the old", with emphasis on establishing a new system of clean energy supply before getting rid of the old, coal-fired power plants. Responding to the criticism on coal, Xi stated that "[w]e will use coal in a cleaner and more efficient way and speed up the planning and development of a system for new energy resources."

President Xi further emphasised the importance of energy security by saying that China will "increase the exploration and extraction of oil and gas resources, increase reserves and production, and accelerate the planning and construction of new energy sources; coordinate hydropower development and ecological protection; actively develop nuclear power in a safe and orderly manner; and strengthen the construction of energy production, supply, storage, and marketing systems to ensure energy security."

The reluctance to commit to a rapid phase out of coal is now seen in China as realistic as the majority of China's energy supply still relies on coal. Even more than that, current geopolitical instability, particularly the Russia war on Ukraine, has pushed many countries, including China, to favour the priority of energy security over climate security. This is seen as the justification for creating new fossil fuel sources.

SANDAOLING OPEN-PIT COAL MINE, HAMI, XINJIANG, CHINA. IMAGE: DARMAU

Currently, China produces about a third of all global CO_2 emissions – some 12,000 Mt CO_2 per year.[6]

By comparison the USA, second in the world league table of emitting nations, emits approximately 5,000 Mt CO_2 per year. As a result, China's short- and mid-term efforts have a major impact on global ambitions to achieve a climate-safe pathway for humanity. In the face of these challenges China is accelerating the take-up of wind power and solar PV (now leading the world in both, with a third of global wind power in China, and moving ahead of the EU in solar PV in 2022). It continues to grow hydropower, and is bringing on nuclear power (with enough projects under construction, awaiting license, or announced to provide power equivalent to, say, Germany's total consumption).

China remains committed to 'strive to' reach peak CO_2 emissions by 2030 and net-zero by 2060. Those objectives are inconsistent with the quest for new fossil fuel sources. China has been laying the ground for an accelerated energy transition from about 2030.

Even if China was to meet its current aspirations (peak-carbon by 2030, and carbon neutrality by 2060) the rest of the world would have to carry some of China's theoretical share of deep and rapid emissions reduction in order to allow the world a chance of staying within the Paris Agreement aspiration of less than 1.5°C temperature rise over pre-industrial levels. If China wavers from those commitments, the world faces a much more challenging future for humanity.

WIND TURBINES AT MODOU MOUNTAIN, YUNNAN, CHINA. IMAGE: LUO LEI

POWERLINES AT SUNSET. IMAGE: LIN ZHANG

Guiding principles

1. CREATING AN ENABLING ENVIRONMENT

Given that China is responsible directly for about a third of the emissions of the whole world, what China does matters to the whole world. So the primary concern for the whole world should be 'What enabling environment will ensure that China can and does deliver extremely rapid emissions reductions?

If China is falling short of expectations, an important question is, 'What more could the world be doing to secure China's best efforts?' This approach would support China to achieve rapid emissions reduction, as well as energy security, livelihood stability for its population, vibrant trading with the rest of the world – and management of complex global geo-politics.

2. PARTNERING TO LOWER EMISSIONS

As part of China's rapid transformation in many areas, it trades with almost every country in the world. Chinese-manufactured phones are ubiquitous around the world, and China itself is a vibrant marketplace for globally produced phones.[7] Solar PV panels all over the world have been manufactured in China. Across the African continent trade with China is expanding. Economies great and small, old and new, across diverse sectors from industrial to domestic scale, are trading with Chinese businesses.

This global interconnectedness with China offers space for constructive partnerships to promote the energy transition. Across this diverse landscape the world can ask, 'In the construction industry, in the telecoms and electronics industry, in clothing manufacture, in battery and electric vehicle innovation, what are the partnerships that can be mobilised to work on emissions together?' The aim would be to secure delivery of goods everybody wants, but with the emissions pathway that everybody also wants. It will take constructive and creative partnerships, supported by governments around the world, to find the pathways that deliver the well-being and future safety needed for a safer future.

3. COMMITMENT TO EQUITABLE GROWTH

Successful pathways for China's energy transitions will not be at the expense of China's focus on improving the well-being of its own population. At present, GDP per person is around $12,000 a year in China. Typically, OECD countries have GDP per person at around $40,000 a year, showing roughly the current gap in consumption.[8] China's aspirations to continue to build well-being are natural, and more developed economies must acknowledge the premise that China aspires to comparable living standards for its population.

For reasons identified in this report, a dual pathway of economic growth and rapid emissions reductions for China is achievable, and global efforts should seek to support mutually beneficial strategies that will achieve success, accelerate the energy transition and help to maintain China's focus on that priority.

WIND TURBINES, QINYUAN, CHANGZHI, SHANXI, CHINA. IMAGE: CAJEO ZHANG

The Great Divergence

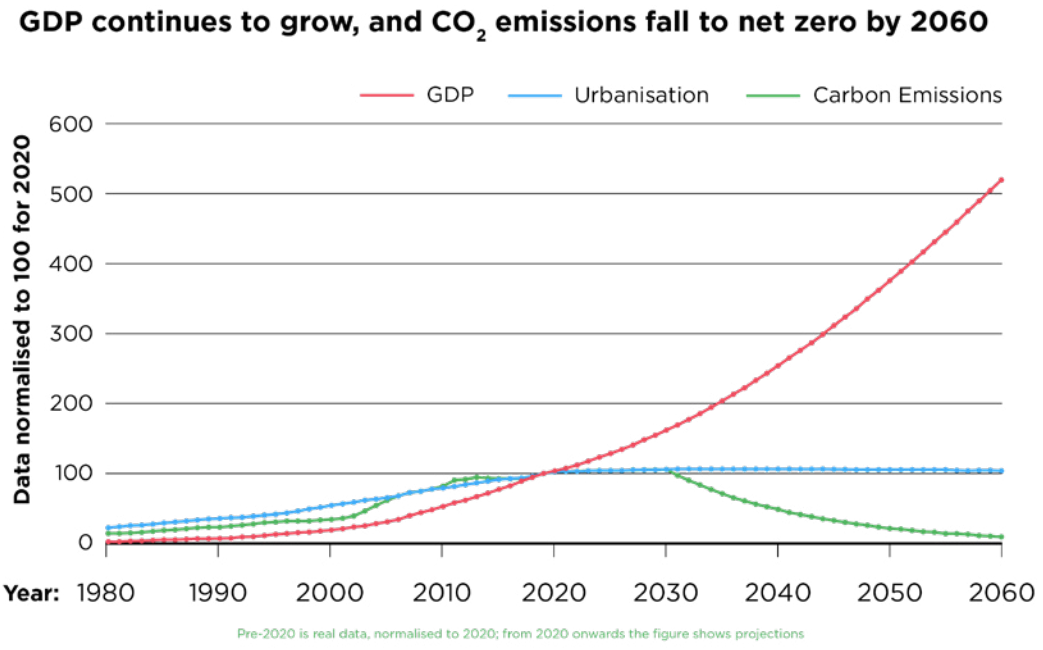
CCAG's Professor Qi Ye is confident that the overall strategy and targets outlined in China's domestic policy can be achieved. The shift in focus to prioritising energy security is discouraging. But there remain good grounds for expecting the energy transition to take place.

Professor Qi notes, for example, that take up of electric vehicles (EVs) has outstripped China's domestic targets. Instead of hitting its target of 20% of market share by 2025, EVs in China have hit about 25% of market share in 2022.[9] This represents new choices being made by consumers: price, future maintenance costs, low running costs and image all play a part in these decisions. The energy transition in vehicle preference is reaching a critical mass that will tip the whole industry towards EVs.

Professor Qi's assessment of China's projected transitions pathway (see Figure 3) shows the country's historic economic growth, urbanisation and emissions growth over 40 years, before a levelling-off of population and emissions during the transition period of 2020 to 2030. This will be followed by a steep drop in emissions to net zero over roughly 40 years.[10] Prof Qi assesses that the foundational conditions for this transformation are in place, saying: 'This is the beginning of the 'Great Divergence'.'

FIGURE 3

THE 'GRAND DIVERGENCE' WHERE URBAN POPULATION REMAINS STABLE, GDP CONTINUES TO GROW, AND CO_2 EMISSIONS FALL TO NET ZERO BY 2060



The world may encourage faster progress – and should organise itself to support acceleration. The transition to EVs is an example of how China's targets may be exceeded as policies and consumer preferences play out.

Professor Qi Ye

EVS – THE NEW ENGINES OF GROWTH

In 2021, China consolidated its position as the world's largest market for EVs, securing a total market share of 12.3%.[11]

The effort of the Chinese government to electrify the domestic automotive industry has helped the average price of EVs fall to €31,829 – 33% less than the average price of a gasoline car.

More than half of all EVs in the world are now manufactured in China, while more than half are driven in China.[12] Chinese consumers note that running and maintenance costs of EVs are lower than those associated with combustion-engine vehicles, far outweighing home charger and other costs.[13]

China's policies aim to make EVs practical all over the country. Interoperability of charging systems is mandated (since 2013).[14] Most public charging points are in densely populated areas, but are being systematically extended into rural regions. The system will meet the needs of 20 million cars by 2024.[15] By May 2022 the 1.4 million charging points were increasing by tens of thousands a month.'[16]

The speed and momentum of China's transition to EVs has developed suddenly; but it has not come from nowhere. For over a decade the government in China has been backing EVs. The need to combat the country's air pollution, the influence of entrepreneurial leadership, and the country's financial subsidies all contributed to the rapid adoption rates.[17]

FIGURE 4

ELECTRIC VEHICLE MARKET SHARE IN CHINA 2018-2021

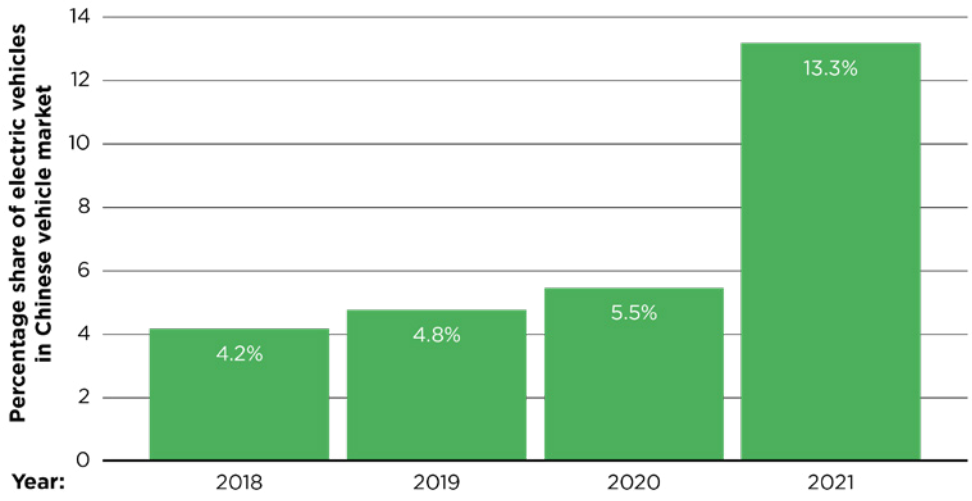


Figure 4 source: Statista

Tracking China's climate-related promises

URBAN PUBLIC CHARGING STATION IN XINING CITY, QINGHAI PROVINCE, CHINA. IMAGE: YOUNG777

CHINA ACKNOWLEDGES THE IMPORTANCE OF ITS GLOBAL ROLE AND, OVERALL, HAS SET CLEAR TARGETS.

Tracking the country's progress against its commitments is relatively easy when compared to other countries, thanks to the clarity of China's policy and reporting against stated objectives. Annex 3 shows the framework that governs China's climate-related policy, with regulation and climate action strongly centralised.

In 2021, China released two key policy documents:

1. ***Working Guidance:*** a top-level account of China's plan for achieving each of the 2030 and 2060 goals; and

2. ***Action Plan:*** a detailed plan showing how different industries must decarbonise to meet the overall 2030 commitments.

1 + N

Encompassing these two documents, China has established a '1+N' policy framework. The '1' refers to the *Working Guidance* document, and 'N' represents a variety of auxiliary documents concentrated on industries, fields, and goals. The *Action Plan* was the first 'N' document to be released. The aim of the 1+N policy framework is to outline a step by step decrease in energy use, or a shift to sustainable electricity and production methods, with the overall goal of slowing the growth of high-emissions industries and regions of the economic system.

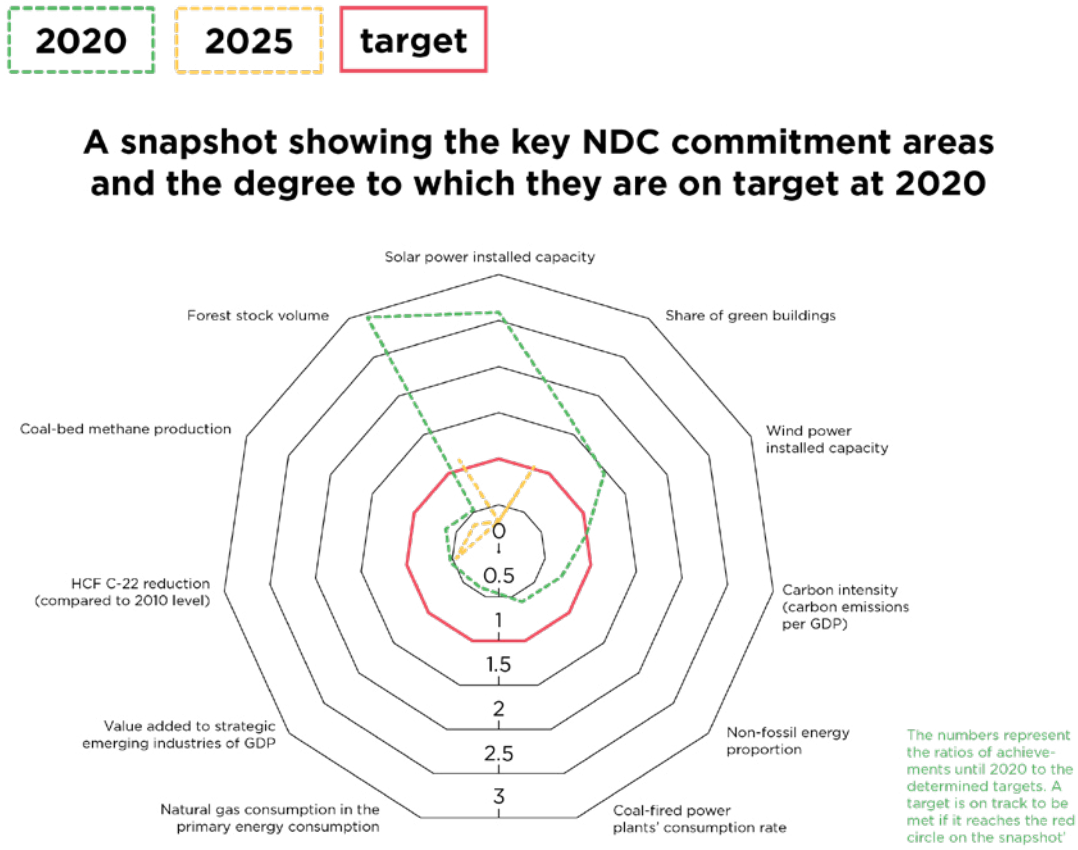
This framework demonstrates how China has made its objectives easy to follow and monitor – setting it apart from other countries whose NDCs may not be as easily cross-linked to national policies and regular monitoring.

China's updated NDC objectives, submitted in 2021, show increasing aspirations for renewable electricity capabilities, which are key to the country's aim for peak CO_2 emissions by around 2030, and carbon-neutral status by 2060.

China is currently exceeding some of its NDC commitments while falling short on others (see figure 5).

FIGURE 5

A SNAPSHOT SHOWING THE KEY NDC COMMITMENT AREAS AND THE DEGREE TO WHICH THEY ARE ON TARGET AT 2020



China's targets (self-imposed and captured in its NDCs) for re-foresting, as well as solar and wind-power generation have all been exceeded – boding well for its energy transition targets. The target rate for coal-fired power generation as a proportion of the energy mix has also been met.

Figure 5 source: Our World in Data; World Bank; Statista; National Energy Statistics; National Bureau of Statistics; United Nations-Climate Change, 2015, 2021; Innovative Green Development Program, 2021

Notes: (A target is on track to be met if it reaches the red circle on the snapshot)

POWER PLANT CHIMNEYS, XIAN, CHINA. IMAGE: CLAUDINE VM

PROGRESS TO DATE

China has made significant progress in its electricity transition when measured against its NDC commitments, or indeed by any measure.

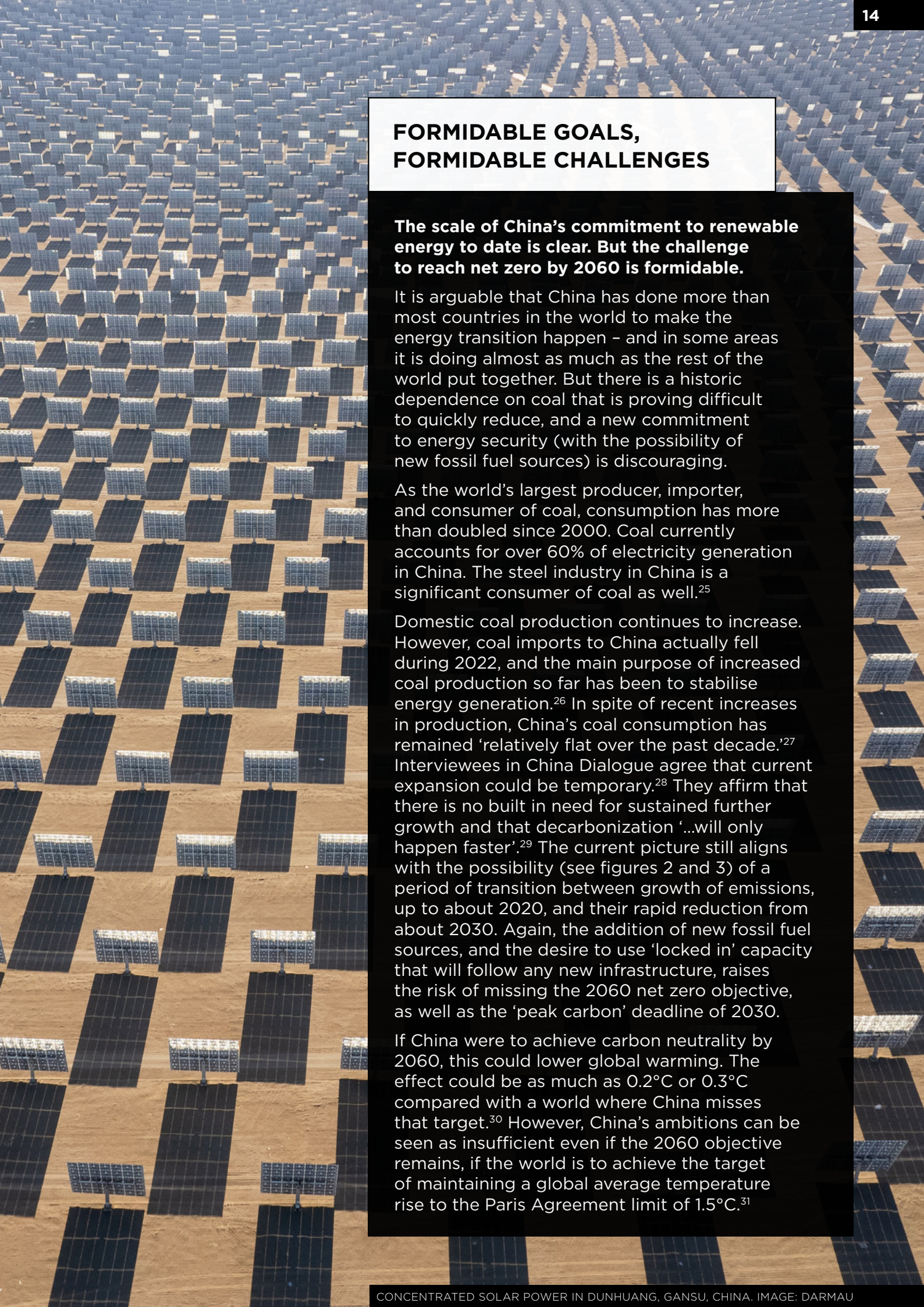
China leads the world in speed of uptake, and in scale of deployment. By the end of 2020 China had 253GW of installed solar PV capacity, making it the world leader, ahead of the EU;[18] then in 2021 it added another 54GW solar PV capacity bringing the total to around 306GW. China is expected to add between 75GW and 90GW in 2022, maintaining faster year-on-year increases, in spite of supply chain challenges.[19] Over the next few years China is expected to add a further 83GW to 99GW per year.

China plays a major part in solar PV manufacture for installation around the world, with a 97% market share of silicon wafer production, 79% of PV cells, and so on. China's commitment to a transition supported by solar PV at scale has been clear, whether for its own production of electricity, or for its place in the future global energy equipment market.

At the same time, China is expanding its offshore wind energy capacity, and now leads the world in active power generation. A third of all global wind power expansion between 2010 and 2020 took place in China, and almost half of the world's total wind power generation is in China. One in five turbines came from Mingyang, China's largest private wind turbine manufacturer.[20] The cost of electricity produced in off-shore wind farms is falling to that of coal.[21] China's current active capacity is 23.9GW, with the UK currently in second place at 12.5GW. A further 40GW or more is in the pipeline in China. (For comparison, however, the UK has a further 66GW in the pipeline.)

Hydropower has been an important part of the energy transition, currently providing more power than solar PV, but growing more slowly. About 16% of China's power mix comes from hydropower, with 370GW in 2020[22] and a further 23 GW added in 2021. Over the five-year period to 2021 the world averaged an annual increase in hydropower of 22GW per year – and over half of this global addition was in China.[23]

Nuclear power will be an important part of China's decarbonisation strategy. 228 reactors are currently under development, of which 19 are under construction and 43 are awaiting permits. The rest have been announced. China will generate some 246GW once these are complete, about half of all of the world's planned nuclear power expansion.[24]



FORMIDABLE GOALS, FORMIDABLE CHALLENGES

The scale of China's commitment to renewable energy to date is clear. But the challenge to reach net zero by 2060 is formidable.

It is arguable that China has done more than most countries in the world to make the energy transition happen – and in some areas it is doing almost as much as the rest of the world put together. But there is a historic dependence on coal that is proving difficult to quickly reduce, and a new commitment to energy security (with the possibility of new fossil fuel sources) is discouraging.

As the world's largest producer, importer, and consumer of coal, consumption has more than doubled since 2000. Coal currently accounts for over 60% of electricity generation in China. The steel industry in China is a significant consumer of coal as well.[25]

Domestic coal production continues to increase. However, coal imports to China actually fell during 2022, and the main purpose of increased coal production so far has been to stabilise energy generation.[26] In spite of recent increases in production, China's coal consumption has remained 'relatively flat over the past decade.'[27] Interviewees in China Dialogue agree that current expansion could be temporary.[28] They affirm that there is no built in need for sustained further growth and that decarbonization '...will only happen faster'.[29] The current picture still aligns with the possibility (see figures 2 and 3) of a period of transition between growth of emissions, up to about 2020, and their rapid reduction from about 2030. Again, the addition of new fossil fuel sources, and the desire to use 'locked in' capacity that will follow any new infrastructure, raises the risk of missing the 2060 net zero objective, as well as the 'peak carbon' deadline of 2030.

If China were to achieve carbon neutrality by 2060, this could lower global warming. The effect could be as much as 0.2°C or 0.3°C compared with a world where China misses that target.[30] However, China's ambitions can be seen as insufficient even if the 2060 objective remains, if the world is to achieve the target of maintaining a global average temperature rise to the Paris Agreement limit of 1.5°C.[31]

CONCENTRATED SOLAR POWER IN DUNHUANG, GANSU, CHINA. IMAGE: DARMAU

CHONGQING AT NIGHT, CHINA. IMAGE: HARRISON QI

ECONOMIC GROWTH AND ITS IMPLICATIONS FOR CHINA

With an average growth of nearly 10% per year of GDP since 1980, China has become the world's second-largest economy and the largest trading nation.[32]

This economic performance has arisen from a combination of strong productivity gains and successful industrialisation – with the benefits of a large labour supply linked to China's rapid absorption of rural workers into modern urban manufacturing sectors. Even after 2012, while the rate of growth of the Chinese economy started to slow, it remained one of the fastest growing in the world.

Daily median income has risen faster than GDP in the last 30 years (see figure 6), signalling real economic improvement for the working population. Gross National Income (GNI) per person has actually grown more than ten-fold since 2000, reaching $10,410 in 2018. That is significantly less than is typical in OECD economies, where annual GNI per capita is over $40,000, but represents rapid gains.

As a result of its economic performance and policies, China has a rapidly rising number of middle-class citizens.[33] China's middle-class was among the fastest growing in the world – rising from around 3% of the population in 2000, to more than half by 2018 – some 707 million people.[34,35] This has been China's great development achievement over a 20-year period. However, as middle-class aspirations become dominant in the population, new consumption habits – while currently remaining well below those of Europe or the US – make increasing

demands on energy consumption, natural resources, manufactured goods, and food systems. Against this background, the model discussed in figure 3 – the Great Divergence – can be perceived in real outcomes shown in figure 6: the diverging trajectories of annual CO_2 emissions (in red - levelling out) and GDP growth (in yellow - continuing to climb).

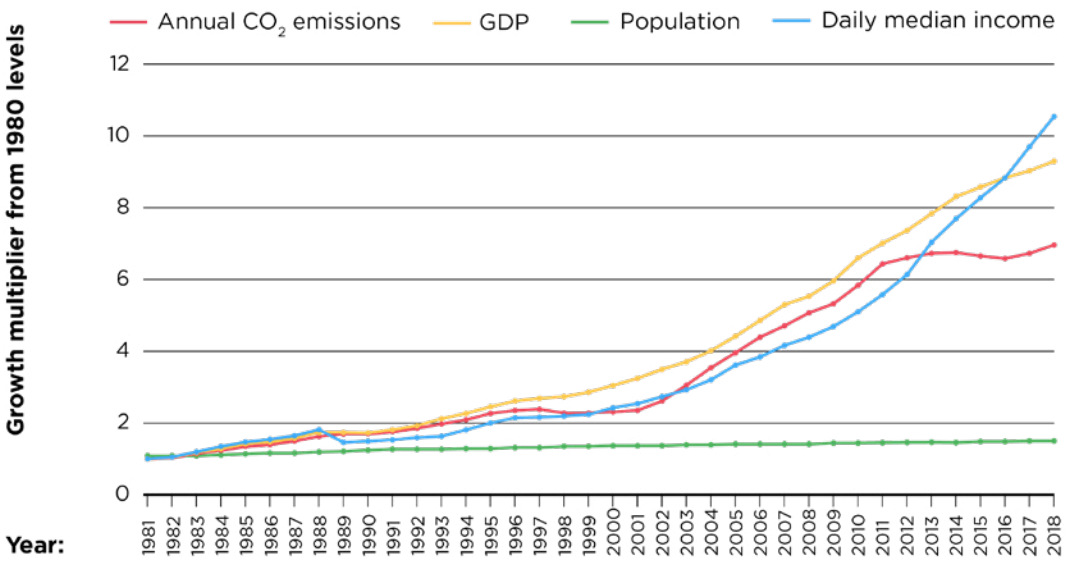
China's electricity demand grew by 10% in 2021– faster than its economic growth of 8.4%. The growth in electricity is consistent with new consumption habits in China amongst the growing middle class. As the growth in energy demand outpaced the increase in the supply of low-carbon sources, coal was used to meet more than half of the recent increased demand for electricity, despite the fact that China is also seeing its greatest increase in renewable energy generation.

China's rate of industrialisation, together with the new consumption habits of its rapidly growing middle-class, has changed energy consumption, putting upward pressure on CO_2 emissions. As more Chinese citizens achieve greater wealth, China's emissions are likely to increase beyond the targeted 2030 peak unless the efforts for transition to renewable energy are sustained.[36]

Currently, China emits about 8.2 tons of CO_2 per person each year. This is well below Australia and the USA, with over 15 tons and 13.6 tons per person per year respectively. However, each person in China now emits more on average than a person in Europe, where emissions are around 6 tons per person (having fallen from around 8.5 tons per person in 1990).[37] A successful energy transition in China is crucial to ensure that rising living standards are maintained, whilst ensuring they do not equate to ever-higher emissions. As the class structure and economy evolves, China has been committed to avoiding such a pathway. It must stay on that pathway and intensify its efforts.

FIGURE 6

ECONOMIC GROWTH SINCE 1980 WITH POPULATION STABILITY AND CO_2 EMISSIONS GROWTH



CO_2 emissions rose steadily from the 2000s as China's economy took off, but began to flatten out after 2010. However, economic growth did not slow down, and typical daily income has risen even faster, showing how China is decoupling growth from emissions.

Figure 6 source: Our World in Data; World Bank

Note: The y-axis represents the rates of annual absolute values compared to the 1980 levels.

Driving down historical sources of GHGs...

China's success story of economic development has clearly been accompanied by increases in carbon emissions. The structure of China's economy gives insights into the challenges remaining.

China's success story of economic development has clearly been accompanied by increases in carbon emissions. The structure of China's economy gives insights into the challenges remaining.

Power generation is the greatest consumer of coal in China contributing about 42% of CO_2 emissions in 2019.[38] Whilst the share of coal in China's total energy consumption mix dropped to about 55% in 2021, from 56% in 2020 (and down from 70% in 2000) there is still substantial reliance on coal for nearly 60% of China's growing electricity requirements (see figure 6). In absolute terms, coal was a source of almost three times as much energy in 2021 as in 2000.[39,40]

Based on projections for uptake in renewables and nuclear power generation, consumption in the power sector will peak around 2028, with CO_2 emissions peaking in that sector the following year. This depends on the continued growth of renewables and their integration into the grid.[41] China's share of non-fossil fuel sources deployed in the total energy mix has risen from below 4% in 2010 to around 18% – and continues to grow rapidly. China leads in renewables research as well as deployment. There is, therefore, a plausible pathway to net zero emissions, with renewables (and nuclear) gradually replacing coal and gas-fired power stations.

The pathway for steel and concrete is different. Steel currently accounts for 15% of China's emissions, and cement another 12%.[42] Their peaks – anticipated to be in the early to mid-2020s – are driven by a drop in manufacturing output, rather than alternative manufacturing methods.

China currently produces more than half of the world's steel and cement, and the CO_2 emissions from those two sectors alone are higher than the European Union's total CO_2 emissions. The pathway from 'peak' to net zero is dependent on China changing its industrial profile from 'the world's factory' to a 'powerhouse of low carbon products'. Considerable investment will be required in these sectors if they are to be part of the new vision for China.[43] Achieving carbon neutrality is a massive challenge ahead.

Whilst the challenges to reduce reliance on coal from the energy mix are severe, the position on steel and cement production (plus coal chemicals) remains unclear.

China has done a lot to deliver a triple bottom line: for the environment, the energy-generation transition is well underway, and the future plans are plausible; for economic growth, GDP has been sustained as reliance on a carbon economy has begun to reduce; for social well-being, median income has risen throughout, and health and life-expectancy measures reflect this. However, this should not mask the need for greater speed in the emissions reduction process, nor the major challenges ahead.

...but facing upticks in emissions

Until the mid to late 1950s, China's carbon emissions were low, and more-or-less static (see figure 1a). By contrast, growth of emissions has been rapid throughout the 2000s, showing a levelling out and small downturn in the 2010s, but drifting upwards from 2017 (see figure 1b).

During the 2015 United Nations Climate Change Conference, the Chinese government pledged that CO_2 emissions would peak around 2030. This has now been updated to "strive to achieve maximum CO_2 emissions by 2030".

Some emissions were avoided due to the economic slowdown of the COVID-19 pandemic: estimates based on satellite data place the savings in China at around 11% between January and April 2020. However, by the end of April 2020, emissions levels had bounced back to 2019 levels.[44]

In 2021, China's CO_2 emissions exceeded 10.7 billion tons, amounting to 33% of total global emissions. This most recent increase in emissions has been largely due to an increase in demand for electricity, relying in the short term on coal-fired power, as well as a steady increase in renewable-energy source generation.[45] However, the recent policy-defining speech of President Xi suggests that the importance of reducing the emissions is secondary to China's stable and secure energy supply. It is to be hoped that this shift in emphasis will not derail the energy transition process that seems to be underway.

FIGURE 7

PRIMARY ENERGY CONSUMPTION BY SOURCE 1985 TO PRESENT

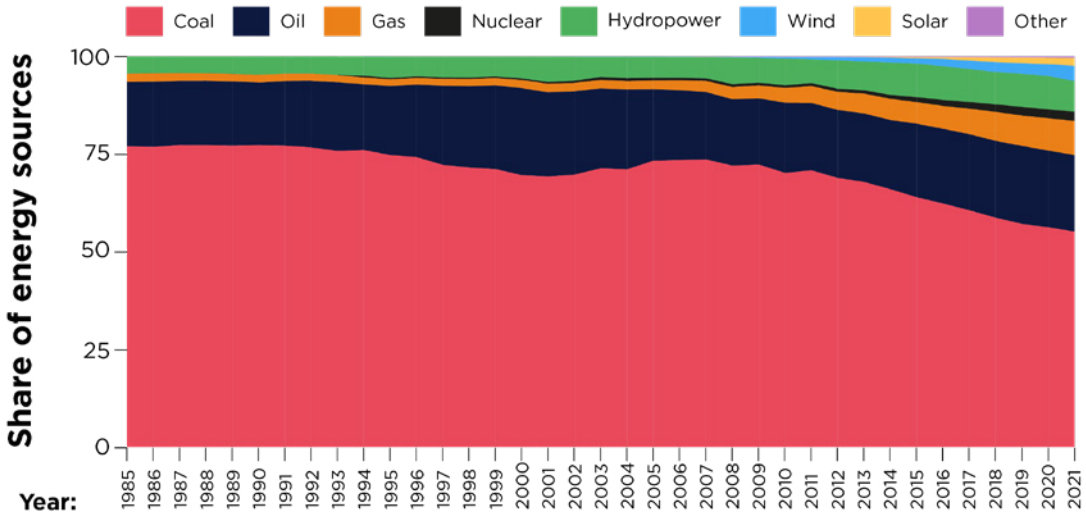


Figure 7 source:
Our World in Data;
World Bank

FOREST CANOPY, SHANDONG, CHINA. IMAGE: LU FUYI

The plan to meet climate commitments

CHINA'S ACTION PLAN FOCUSES LARGELY ON 10 ACTIONS TO ENSURE PEAK CARBON EMISSIONS ARE REACHED NO LATER THAN 2030.

Published in November 2021, the Action Plan laid out how the goal would be achieved, containing an itemised overview of how industry would gradually shift to sustainable methods and energy-sources. Broadly the pathway sets goals for 2025, 2030 and 2060.

By 2025, the country aims to reduce energy consumption by over 13% per unit of GDP, from all sources. Over the same time period, it also seeks an 18% reduction in emissions from 2020 levels.

By 2030, under current targets, the energy mix will have shifted to 25% non-fossil fuel (from the current 18% or so), representing the peak of CO_2 emissions from China.

Other 2030 targets include further reductions in energy use per unit of GDP, a drop in CO_2 emissions by over 65% from 2005 levels, and a significant increase in wind and solar power generation.

Forest cover will also increase to 25% of land area, growing forest stock volume to 19 billion cubic metres.

By 2060, over 80% of the energy mix will be non-fossil fuel, and China will have achieved carbon neutral status.

Predictions have generally been optimistic about China's ability to reach the targets it sets itself, with its rapid modernisation causing large upgrades in power efficiency, productivity, and a sustained decline in carbon intensity. These trends couple with a steep increase in renewable energy use and ambitions to bring nuclear power into the mix as well as increasing national carbon sinks through reforestation at scale.

More recently, doubt has been expressed about China's emissions reductions in the face of increases in coal production and deployment. However, these could be temporary, and do not of necessity change China's overall plans and pathway.

ECONOMIC GROWTH IN THE FACE OF STRUCTURAL CONSTRAINTS

The drivers of China's growth – historically based on resource-intensive manufacturing, exports, and low-wage labour – have begun to shift.

China's continued economic growth depends on development of its new engines of growth: the green energy sector, EVs and IT equipment, for example. These sectors offer the chance to address the social and environmental future for China, as well as its GDP.

China's industrialisation brought modern economic development and a general increase in the quality of life for many of its citizens, while introducing environmental implications that are felt both locally and globally. Severe pollution, dehydration of waterways, widespread deforestation, and some of the highest levels of air pollution in the world are just a few repercussions incurred by China for this rapid industrialisation. Well-being in the population has suffered, even as economic opportunities have increased.

Many of these challenges can be tackled alongside the energy transition. In 2018, industry and manufacturing accounted for 37% of China's total CO_2 emissions and they continue to rise. Strengthening low-emissions industrialisation and transforming agriculture are therefore essential to China's future.

The proportional contribution of agriculture to the economy – and to emissions – is steadily shrinking, alongside the growth in industrialisation, urbanisation, and increased importation of food. China is now the world's largest agricultural importer, surpassing both the European Union (EU) and the United States in 2019 with imports totalling $133.1 billion.[46] Some of this is imported staples, but there is a rapidly increasing shift to higher value foods, reflecting the rising middle class consumption habits. China now has the largest market for beef in the world.

The vibrant pattern of relationships in trading food highlights the opportunities for multiple countries to partner with China in the bid to reduce emissions. The kaleidoscope of relationships can be seen in Figures 10A and 10B (page 25).

In his recent speech, in addition to the emphasis on energy security, President Xi did also pledge environmental protection. "We must remember to maintain harmony between humanity and nature when planning our development." However, he added that China will promote the "clean and efficient" use of coal and ensure conservation of its diverse ecosystems.[47] There is currently no viable route to 'clean' use of coal, weakening the force of the commitment to harmony with nature.

NANJING ROAD, SHANGHAI, CHINA. IMAGE: KRZYSZTOF KOTKOWICZ

NANJING ROAD, SHANGHAI, CHINA. IMAGE: HANNY NAIBAHO

FIGURE 8

HISTORICAL COMPARISON – CARBON EMISSION BY % PER SECTOR IN CHINA IN 1990, 2005, 2018

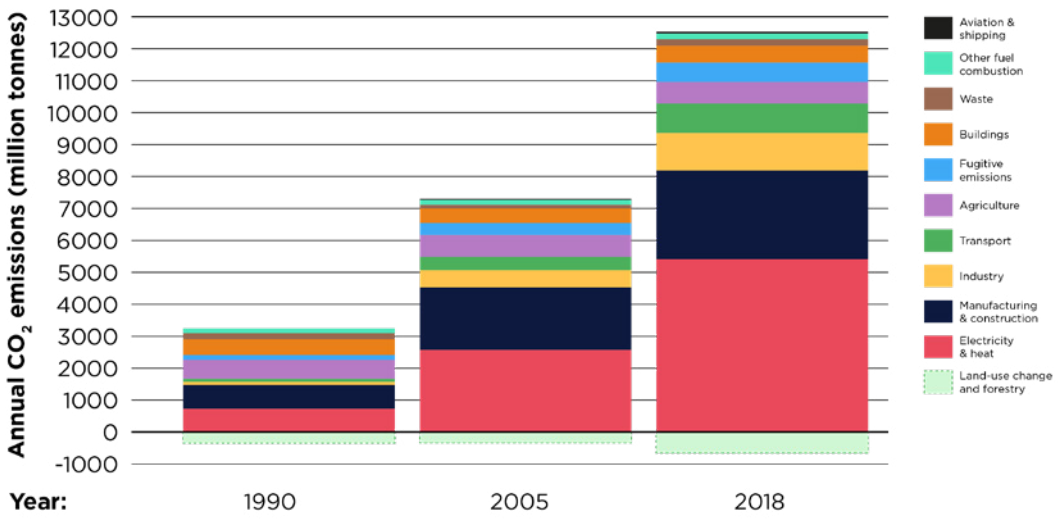


Figure 8 source:
Our World in Data

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1. See Annex 1 for NDCs of 2015 and as updated in November 2021.
2. In the early 2000s over 80% of electricity production came from fossil fuels, whilst in 2021 the proportion was about 66%. Over 33% was low carbon, being renewables plus nuclear. Source: Our World in Data https://ourworldindata.org/explorers/energy?tab=chart&facet=none&country=~CHN&Total+or+Breakdown=Select+a+source&Select+a+source=Low-carbon&Energy+or+Electricity=Electricity+only&Metric=Share+of+total
3. The 20th National Congress is the Once-every-five-years event that sets the direction for major policy issues. At the 20th Party Congress, as expected, President Xi extended beyond his decade-long term, winning a third term as paramount leader. He spelled out some important policy goals in his speech, explaining how the CPC (Communist Party of China) plans to take the country forward. 'Chinese style modernization' is the goal for the next three decades, in two stages of 15 years each.
4. 'Climate Action Tracker' (CAT), for example, gives a negative assessment of China's efforts, rating them as 'highly insufficient' (along with Canada, amongst others) whereas USA is found to be better at merely 'insufficient': see https://climateactiontracker.org/countries/china/. In some ways the unweighted components of the CAT algorithms mask some good efforts China is making. The more nuanced evaluation of 'Climate Change Performance Index', for example, places China just below the middle in a league table of 64 nations assessed for their performance. China (at 38) is well above the USA (at 55) and Canada (at 61): see https://ccpi.org/ranking/. Perhaps the important point is that no nation is doing enough, and China needs to be better than most because of the high impact its efforts have to the world's overall achievements.
5. The content of this section is based on a summary of the speech made available in English in China Daily on 17th October 2022.
6. BP estimate 2021 https://worldpopulationreview.com/country-rankings/co2-emissions-by-country
7. China's Xiaomi brand recently overtook Apple in market share. China remains the largest market for mobile phones, and about 25% of phones shipped around the world go to China. https://www.cnbc.com/2021/07/16/chinas-xiaomi-overtakes-apple-in-global-smartphone-market.html; https://www.statista.com/topics/1416/smartphone-market-in-china/#dossierKeyfigures.
8. GDP is a very blunt measure of well-being, but it is clear that a growing middle class in China will aspire to levels of choice, preference and living standards which bring an increase in household consumption.
9. Up from about 4.9% in 2019. See BBC report of IRENA 2021 report on 2019 data: Brown, BBC (2021) 'Why China's climate policy matters to us all' https://www.bbc.co.uk/news/world-asia-china-57483492.
10. Taken from Qi and Cai (2021) 'Urban governance innovation in the context of carbon neutrality' Governance Studies (in Chinese) http://zlyj.zjdx.gov.cn/article/2021/1007-9092/1007-9092-37-6-88.shtml
11. https://www.jato.com/in-2021-battery-electric-vehicles-made-up-one-in-ten-new-cars-registered-in-europe/
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13. https://theicct.org/sites/default/files/publications/EV-costs-benefits-china-EN-apr2021.pdf
14. A range of government commitments is summarised in a brief article. See Conrad (2022) 'China is racing to electrify its future' https://www.wired.com/story/china-ev-infrastructure-charging/.
15. https://www.electrive.com/2022/08/29/china-targets-installing-ev-charging-stations-along-highways/.
16. The monthly totals from June 2021 were shown by GizmoChina in June 2022. See Wong (2022) 'China has built 87,000 new EV charging stations in May 2022' https://www.gizmochina.com/2022/06/12/china-87000-new-ev-charging-stations-may-2022/.
17. https://www.jato.com/evs-a-pricing-challenge-2021-report/
18. EU had about 151 GW at that time. All data is taken from IEA figures cited in Lynk Global https://lynk.global/insights/chinas-solar-photovoltaic-market-how-it-leads-the-global-clean-energy-race.
19. Reuters makes regular brief reports on China's solar power capacity. These figures were reported in February 2022. See Reuters (2022) 'China's solar power capacity set for record increase in 2022 – industry body' https://www.reuters.com/business/energy/chinas-solar-power-capacity-set-record-increase-2022-industry-body-2022-02-23/.
20. These figures are reported by Energy Monitor in September 2022, drawing on a September 2022 report about Chinese offshore wind published by Institute for Energy Economics and Financial Analysis, USA. See Energy Monitor (2022) 'China's Mingyang to power global growth of offshore wind – IEEFA' https://www.energymonitor.ai/tech/renewables/chinas-mingyang-to-power-global-growth-of-offshore-wind-ieefa#:~:text=China%20boasts%20the%20world's%20largest,largest%20private%20wind%20turbine%20manufacturer.
21. Taking account of lifetime cost of energy installations, the 'levelised cost' of offshore wind is reported as $78 per MWh, and coal is at $76 MWh.
22. See IHA country profile on China (2021) https://www.hydropower.org/country-profiles/china.
23. The hydropower data are reported by Reuters in July 2022. See Reuters (2022) 'China's surging hydropower a boon for its climate goals, energy bills' https://www.energymonitor.ai/tech/renewables/chinas-mingyang-to-power-global-growth-of-offshore-wind-ieefa#:~:text=China%20boasts%20the%20world's%20largest,largest%20private%20wind%20turbine-%20manufacturer.
24. These figures are taken from Energy Monitor report of December 2021. See Energy Monitor (2021) 'Weekly data: China's nuclear pipeline as big as the rest of the world's combined' https://www.energymonitor.ai/sectors/power/weekly-data-chinas-nuclear-pipeline-as-big-as-the-rest-of-the-worlds-combined.

25. China has the world's largest steel industry, producing over a billion tons of steel a year, mostly for domestic consumption. There are challenges to the industry causing a slow-down from its peak.

26. In 2021, China suffered one of the worst power shortages in many years – which led to rolling blackouts in urban areas and forced the closure of factories across parts of the country. As a result, authorities moved to prioritise the stable delivery of electricity, and now China is mining more coal than ever before. In fact, in 2021, China's coal production exceeded four billion tonnes, accounting for half of the world's output.

27. https://www.carbonbrief.org/analysis-what-does-chinas-coal-push-mean-for-its-climate-goals/.

28. https://chinadialogue.net/en/energy/chinas-move-to-increase-coal-supplies-wont-affect-decarbonisation/.

29. Cited in China Dialogue July 2022, Professor Yuan Jiahai from North China Electric Power University (2022) 'China's move to increase coal supplies won't affect decarbonisaton' https://chinadialogue.net/en/energy/chinas-move-to-increase-coal-supplies-wont-affect-decarbonisation/

30. An ODI blog interviews experts on the impacts of China's commitments. Laetitia Pettinotti suggests the impact China can make. See 'China's pledge in the Climate Diplomacy landscape' https://odi.org/en/insights/five-expert-views-on-chinas-pledge-to-become-carbon-neutral-by-2060/.

31. CAT (Climate Action Tracker) in particular classifies China's current plans and NDCs as 'highly insufficient' overall. Part of the reason is that there is lack of ambition in the NDCs themselves – although China will probably exceed its targets within the NDCs. NDCs should be more ambitious so that the rest of the World is motivated to enhance their ambitions and efforts. CAT also seeks greater ambition for China's emissions reductions to achieve a fair share of reductions on a pathway to a 1.5°C limit on global temperature rise.

32. China's GDP in 2021 totalled about $18 billion, with the USA ahead at about $23 billion. The next largest economies are Japan and Germany at between $4 billion and $5 billion. https://www.worlddata.info/largest-economies.php#:~:text=With%20a%20GDP%20of%2023.0,ninth%20place%20in%20this%20ranking..

33. According to the Pew Research Center's income bracket classification: https://www.pewresearch.org/global/2021/03/18/global-middle-class-2021-methodology/

34. In 2000 the total population was around 1.3 billion, and in 2018 it had risen slightly to 1.4 billion. See, for example, https://www.worldometers.info/world-population/china-population/

35. These are the Pew Centre figures cited in US-China Relations (2021) 'China's expanding middle class is starting to look a lot like the US', but it's not a good thing' https://www.scmp.com/economy/china-economy/article/3158753/chinas-expanding-middle-class-starting-look-lot-us-its-not.

36. The link between wealth and carbon emissions in China was noted in Nature Climate Change in 2016, pointing out that a transformation away from carbon intensive lifestyles requires policy interventions. See Wiedenhofer et al (2016) 'Unequal carbon footprints in China' https://www.scmp.com/economy/china-economy/article/3158753/chinas-expanding-middle-class-starting-look-lot-us-its-not Lifestyle choices of the middle classes around the world are known to lead to higher emissions per capita. It is recorded that the richest 10% of consumers emit 44% of consumption-related carbon emissions. See for example Brookings Future Development (2021) 'Missing from COP26: Lifestyle choices of middle-class and rich consumers' https://www.brookings.edu/blog/future-development/2021/11/23/missing-from-cop26-lifestyle-choices-of-middle-class-and-rich-consumers/.

37. https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=EU.

38. As reported by US Energy Information Administration USEIA (2022) 'Country analysis Executive Summary China' https://www.eia.gov/international/analysis/country/CHN.

39. Ibid.

40. See Our World in Data (2020) 'Energy Mix' https://ourworldindata.org/energy-mix#energy-mix-what-sources-do-we-get-our-energy-from.

41. The Natural Resources Defense Council sketches out these proportions and pathways. See Zhang and Wen (2022) 'China's Top Industries can Peak Collective Emissions in 2025' NRDC Blog https://www.nrdc.org/experts/jake-schmidt/chinas-top-industries-can-peak-collective-emissions-2025.

42. 2019 figures also from NRDC Blog. https://www.nrdc.org/experts/jake-schmidt/chinas-top-industries-can-peak-collective-emissions-2025.

43. NDRC Blog. https://www.nrdc.org/experts/jake-schmidt/chinas-top-industries-can-peak-collective-emissions-2025.

44. These figures are higher than other estimates, limited to observations 'on the ground'. These estimates are based on observed pollution measurements and satellite data for NO2 column density. See Zheng et al (2020) 'Satellite-based estimates of decline and rebound in China's CO2 emissions during COVID-19 pandemic' https://www.science.org/doi/10.1126/sciadv.abd4998 .

45. Renewable energy is now providing about 29% of electricity generation in China – up by more than 10% of total demand in 2010. See Tay (2022) ' By the numbers: China's net zero ambitions' (https://www.nature.com/articles/d41586-022-00802-3.

46. This information is drawn from the detailed analysis of China's agricultural industry and its increasing dependency on imports. See USDA Foreign Agricultural Service: Jiang (2020) 'China: Evolving Demand in the World's Largest Agricultural Import Market' https://www.fas.usda.gov/data/china-evolving-demand-world-s-largest-agricultural-import-market.

47. The summary of President Xi's speech in the Guardian drew on Reuters reports. See Davidson et al, Guardian (2022) 'Xi Jinping's vision for China's next five years: key takeaways from his speech' https://www.theguardian.com/world/2022/oct/16/xi-jinping-vision-china-next-five-years-key-takeaways-from-speech

ANNEXES

FIGURE 9

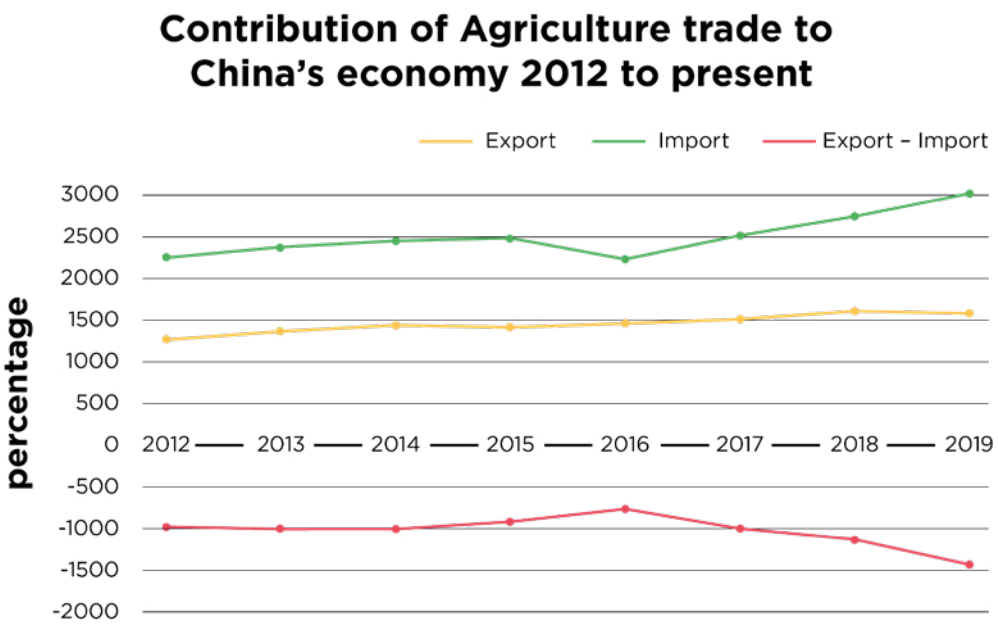


FIGURE 10A

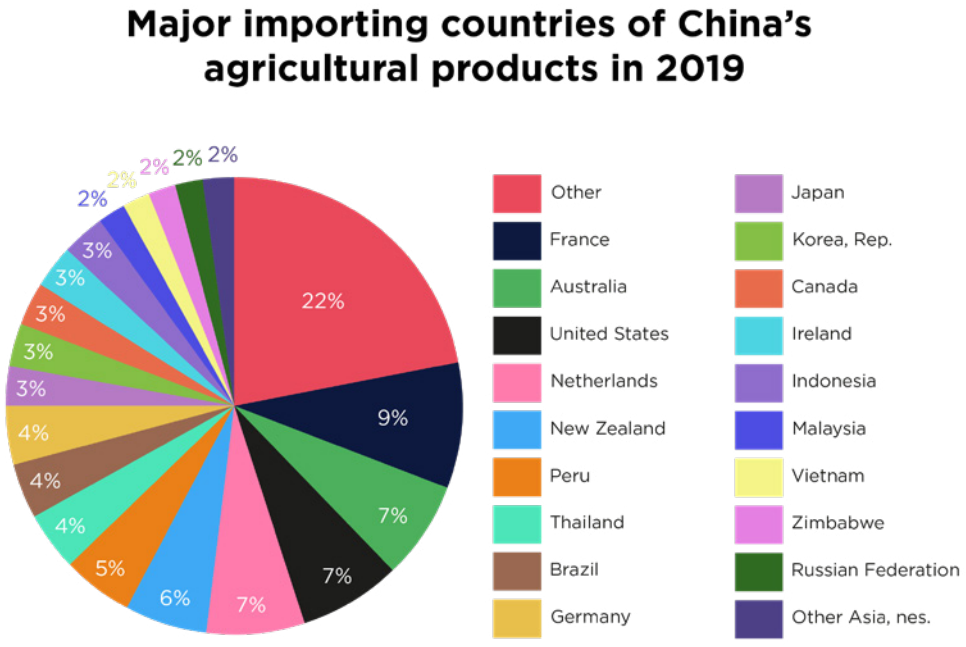


FIGURE 10B

Major exporting countries of agricultural products from China in 2019

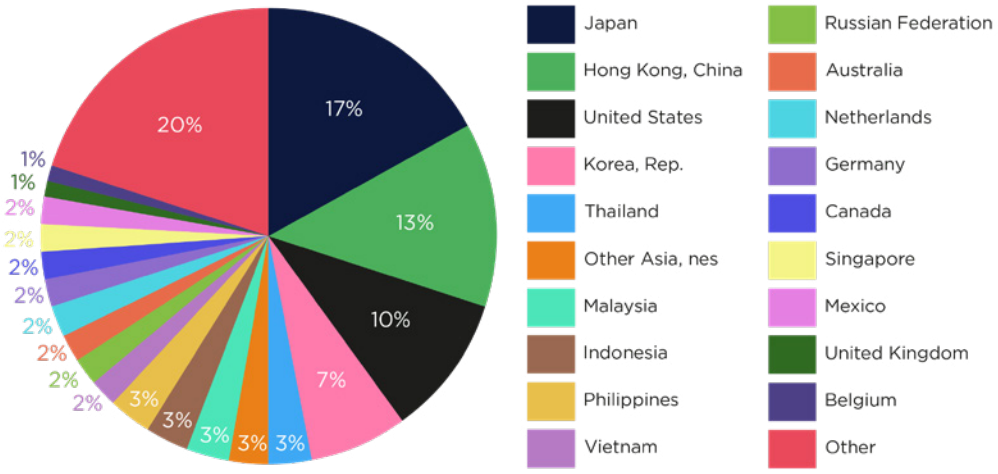
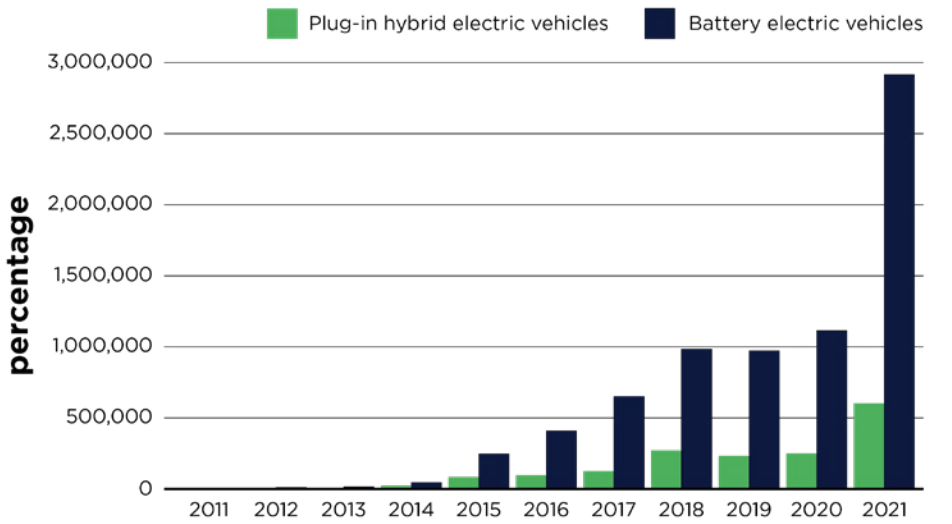


FIGURE 11

Annual sales of new energy vehicles in China 2011-2021



SHENZHEN, CHINA. IMAGE: ROBERT BYE

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