

01 | *year 01*
Sept 2021

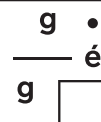
China's Ecological Power:
Analysis, Critiques,
and Perspectives

GREEN



Géopolitique, réseau, énergie,
environnement, nature

Scientific Direction **Stéphanie Monjon**



GREEN

**Géopolitique, réseau,
énergie, environnement,
nature**

Journal edited by Groupe d'Études Géopolitiques.

45, Rue d'Ulm, 75005 Paris
<https://legrandcontinent.eu/>
geg@ens.fr

Scientific Director of this Issue
Stéphanie Monjon

Scientific Committee
Luiza Bialasiewicz, Pierre Charbonnier, Amy Dahan, Patrice Geffron, François Gemmene, Isabelle Kocher, Cécile Maisonneuve, Stéphanie Monjon, Magali Reghezza, Adam Tooze, Shahin Vallée, Françoise Vimeux

Editors-in-chief
Léa Boudinet, Clémence Pèlerin

Editorial Managers
Ramona Bloj, Gilles Gressani

Editorial Committee
Pierre Bégat, Éléonore Delanoë, Charlotte Gardes, Amélie Latreille, Madeleine Leroy, Lauren Lever, Emma Loignon, Océane Mascaro, Vianney Mennecier, Elsa Perrin, Hugo Sancho

To cite an article from this journal
[Name of author / Title].
GREEN, Paris: Groupe d'études géopolitiques,
September 2021, issue 1.

4 **Understanding “Ecological Civilization” According to China**

Stéphanie Monjon, Léa Boudinet, Clémence Pèlegri

6 **Infography • Preface: Chinese Statistics**

Hugo Sancho, Stéphanie Monjon, Léa Boudinet, Clémence Pèlegri

1. CHINA'S CLIMATE AMBITIONS

10 **Infography • China's Climate Goals**

Amélie Latreille, Léa Boudinet, Clémence Pèlegri

11 **Why COPs are Essential to Tackle the Climate Emergency**

Laurent Fabius

13 **How China's Position Has Evolved in the COPs and on the Global Climate Geopolitical Stage**

Amy Dahan

18 **Economic Growth and Climate Change — Beijing's Hard Choices**

Thibaud Voita

21 **China's Climate Realpolitik**

Jean-Paul Maréchal

28 **The 14th Five Year Plan in the New Phase of Chinese Reform**

Michel Aglietta

34 **For an Ecological Realpolitik**

Pierre Charbonnier

37 **Can the EU Lead the Fight Against Climate Change?**

Adam Tooze, Enrico Letta, Laurence Tubiana, Jason Bordoff, Alex Halliday

45 **Climate as an Answer to America's Problems**

David Levaï

2. THE CHALLENGES AND CONTRADICTIONS OF CHINA'S ECOLOGICAL TRANSITION

52 **Infography • China: The World's Largest Consumer of Coal**

Amélie Latreille, Léa Boudinet, Clémence Pèlegri

54 **Governing China's Energy Sector to Achieve Carbon Neutrality**

Philip Andrews-Speed

64 **Sécurité énergétique en Chine et diplomatie climatique vertueuse : le grand paradoxe**

Jean-François Di Meglio

68 **Is China's Oil Sector Oblivious to the Country's 2060 Pledge?**

Michal Meidan

72 **Renewable Energy: Is China's Innovation System Adequate to Enable a Low-Carbon Transition?**

Anders Hove

81 **Civil Nuclear Energy in China**

Mathilde Teissonnière

85 **Understanding the New Silk Roads of Energy**

Eric Armando

92 **China's Uneven Regional Energy Investments**

Han Chen, Cecilia Springer

107 **China's at the Gate of the European Power Grid**

Clémence Pèlegri, Hugo Marciot

3. AN “ECOLOGICAL CIVILISATION”?

106 **Green Transition in China: At What Cost?**

Yfei Li, Judith Shapiro, Clémence Pèlegri

110 **Ecological Policy with a Chinese Twist**

Andrée Clément

117 **The State of China’s Environment: What Has Changed in the Past Few Years?**

Stéphanie Monjon, Léa Boudinet

123 **“One AI to rule them all”: The Unification of Chinese Urban Governance under Artificial Intelligence**

Federico Cugurullo

127 **The New Tools of Environmental Governance in China: Top Down Control and Environmental Credit**

Stéphanie Monjon, Élodie René

135 **China’s Contribution to Low-Carbon Technology Innovation**

Mathieu Glachant, Simon Touboul

139 **Is Chinese Industrial Policy Compatible with its Environmental Ambitions**

Anaïs Voy-Gillis

146 **The EU and China: Climate and Trade Increasingly Intertwined**

Susanne Dröge



Stéphanie Monjon • Scientific Director of this issue, Professor and Researcher, Laboratoire d'Économie de Dauphine, Université Paris Dauphine - PSL University

Léa Boudinet • GREEN Co-editor-in-chief

Clémence Pèlerin • GREEN Co-editor-in-chief

Understanding “Ecological Civilization” According to China

4

Dear readers,

We present to you the first issue of GREEN (Géopolitique, Réseaux, Énergie, Environnement, Nature), a twice-yearly journal published in two languages (French and English) offering a multi-disciplinary analysis of energy, environment, and climate issues.

Even though ecology and climate issues receive wide media coverage, the sheer volume of available information – which can be contradictory and incomplete – can limit the ability to inform and transmit fundamental information on the climate emergency. The scientific discourse is often happening at a frequency that is barely audible to the wider public and civil society.

Two convictions guided the creation of GREEN. First, that environmental and climatic issues deserve to be understood with nuance in order to fully grasp the complexity and multifaceted nature of the challenges that underlie them. Second, the dialogue between the experimental sciences and social sciences on one hand, and between scientific discourse and editorial discourse on the other, are powerful tools to making these subjects accessible and intelligible. This is why we designed GREEN as a place where these dialogues could be reconciled and restored, between the urgency of action and the long term. GREEN is therefore intended for a wide audience: for experts and policy makers and, without sacrificing its technical rigor, the reader who is curious and concerned about environmental and climatic issues.

This ambition is supported by the contribution of a number of French, European, and international researchers as well as a scientific committee which reflects the diversity of the project. Leading academic, political, and economic figures have honored us with their confidence

and respective insights into the environment and climate.

Choosing China as a focus for this first issue was a gamble, but how can we understand the climatic and environmental challenges of our era without considering the world's largest CO₂ emitter, the second largest economy, and seemingly one of the most ambitious States when it comes to climate change?

China's announcement that it intends to reach carbon neutrality in 2060 generated surprise as well as hope within the international community. Surprise, because this goal seems very ambitious as the country's greenhouse gas emissions continue to rise, currently representing 27% of global emissions. Hope, because with this announcement, China is demonstrating its support for the initiative launched by the Paris Agreement which was seriously compromised by the Trump administration's choice to withdraw from it. The year 2020 was supposed to be a pivotal one: the countries that had signed the Agreement had pledged to strengthening their commitments to reducing their greenhouse gas emissions if necessary. China, followed by Japan and South Korea, successively announced their intention of reaching carbon neutrality in 2060 for the first, and 2050 for the two others. The European Union, which introduced the goal of carbon neutrality in its Green Deal of 2019, recently reached an agreement with its member states to reduce its emissions by 55% between now and 2030. In the United States, then Democratic presidential candidate Joe Biden had announced, as early as the summer of 2020, his goal of “zero emission” domestic electrical production by 2035. Uncertainty remains, however, whether these announcements are feasible given current public policies. Chinese investment, particularly in high-carbon assets, both at home and along the New Silk Roads, leave room for only modest optimism. On a global scale, the Covid-19 pandemic raised hopes that the world economy would see a lasting reduction in its energy intensity. However, the resulting decrease in emissions was short-lived, and no lasting change can be seen.

China's ambitions toward reducing CO₂ emissions – the Chinese government's announcement of carbon neutrality is limited to carbon and not all greenhouse gases – is not enough to ignore the complexity and diversity of the challenges which that country must face to effectively fight pollution and the widespread destruction of ecosystems which are necessary for life. Far too often we consider climate as the be all and end all when it is only part of the equation for preserving the planet.

In terms of climate change, the Chinese government's proactive rhetoric (which has only been the case for a few years, see the articles by Amy Dahan, p.13, and Andrée Clément, p. 110) underscores the highly geopolitical nature of the fight against climate change. This ambition

raises questions despite its apparent virtue – the ecological transition appears to be an implicit lever of power for economic growth, garnering market share in several industrial sectors and influence on the international stage. However, the economic and diplomatic benefits seem to outweigh the actual benefits in the fight against climate change (see the article by Jean-Paul Maréchal, p. 21). This is covered in the first part of this volume.

The climate issue naturally leads to the energy issue which is the main driver of climate change on the global level. This is why China's relationship to energy deserves close examination, for the so-called "low carbon" technologies – renewable and nuclear energies, electric vehicles, etc. – are now at the heart of China's strategy to decarbonize its economy and reduce its emissions. In key technologies such as photovoltaic and wind, China has invested more rapidly than any other country on Earth. And yet coal, which already makes up the majority of the country's energy mix, continues to be developed by China both at home and abroad through its New Silk Roads (see the articles by Eric Armando, p. 85, and Han Chen and Cecilia Springer, p. 92). More generally, carbon infrastructure makes up a significant part of the overall volume of China's Silk Roads investments – where does this leave the feasibility of China's energy transition and the fulfilment

of its climate commitments? This is the question that we will attempt to answer in the second part of this volume.

Beyond energy and climate, the third and final part of this volume questions, in a larger sense, the idea of ecological civilization that has been written into China's constitution since the 2000s and reaffirmed in 2017 by Xi Jinping. Ecology is concerned with the interactions and interdependence of living things between themselves and their environments. Beyond climate, an ecological civilization is therefore based on respect for the environment and planetary limits. And yet, China's air and soil quality is still concerning despite the announcement in 2014 that the country was going to war against pollution (see the article by Stéphanie Monjon and Léa Boudinet, p. 117). Furthermore, the Chinese Communist Party's growing interventionism in the environmental sphere can be seen in little-known issues, such as the digitalization of cities (see the article by Federico Cugurullo, p. 123) and the development of new economic governance tools such as environmental social credit (see the article by Stéphanie Monjon and Elodie René, p. 127). This leads to the questions raised in the third chapter of this volume: what does the Chinese "ecological civilization" consist of today? Does this ambition lead to the strengthening of Chinese authoritarianism?



Hugo Sancho • GREEN Editorial committee

Stéphanie Monjon • Scientific Director of this issue, Professor and Researcher, Laboratoire d'Économie de Dauphine, Université Paris Dauphine - PSL University

Léa Boudinet • GREEN Co-editor-in-chief

Clémence Pèlegri • GREEN Co-editor-in-chief

Preface: Chinese Statistics

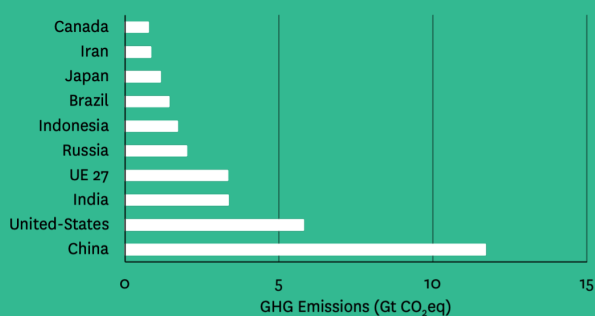
Greenhouse Gas (GHG) • Gases that absorb infrared radiation emitted by the Earth's surface, contributing to the greenhouse effect. There are many GHGs naturally present in the atmosphere, but their concentration varies due to human activities. Their impact on climate depends on their capacity to absorb and emit infrared radiation, their concentration in the atmosphere, and their life span.

Electricity vs. Energy • Electricity is a secondary energy or an energy vector because it is generated from the transformation of a primary energy by means of a conversion system. Primary energy is energy that is directly available in nature, such as fossil fuels, geothermal energy, solar radiation, wind, or biomass. Electricity is difficult to store in sufficient quantities and at affordable costs in order to satisfy our energy needs.

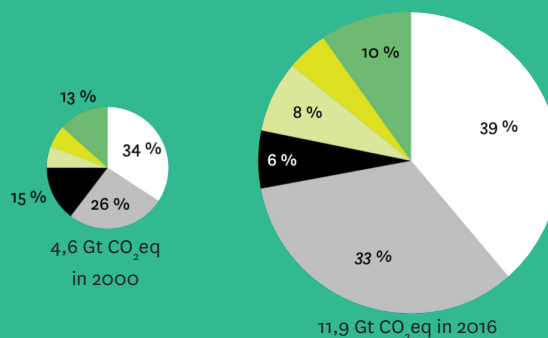
Capacity Factor • Capacity factor of a power plant or wind turbine is the ratio of energy produced over a given period of time versus the energy it could have generated if it had been operating constantly at full output for the same period. For example, a nuclear power plant has a capacity factor between 75% and 80%, an onshore wind turbine around 25%, and solar panels around 15%.

6

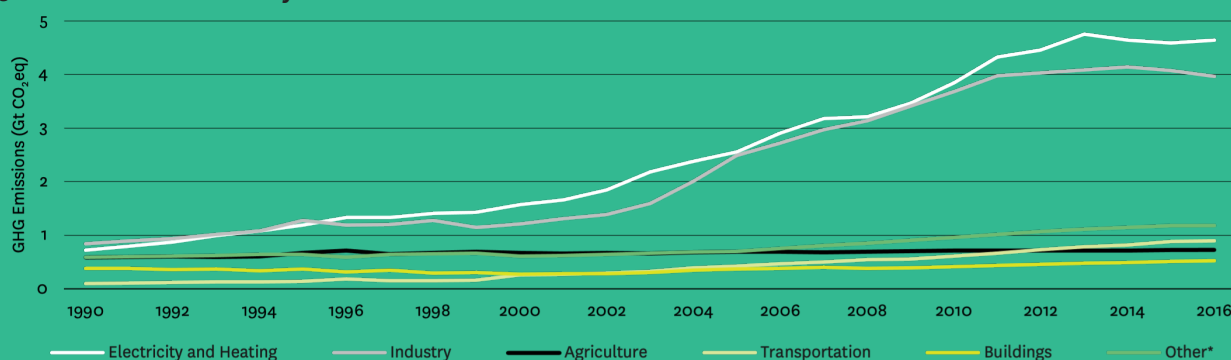
1. The 10 largest GHG emitters in 2016^{1,2}



2. Chinese GHG Emissions by sector in 2000 and 2016^{1,2}



3. Chinese GHG Emissions by sector^{1,2}



China's GHG emissions have risen sharply in the past 20 years, surpassing the EU in the early 2000s. The electricity and heat generation sectors as well as industry are largely responsible for this increase and together account for more than 80% of total emissions.

1. Climate Watch, World Resources Institute, 2019

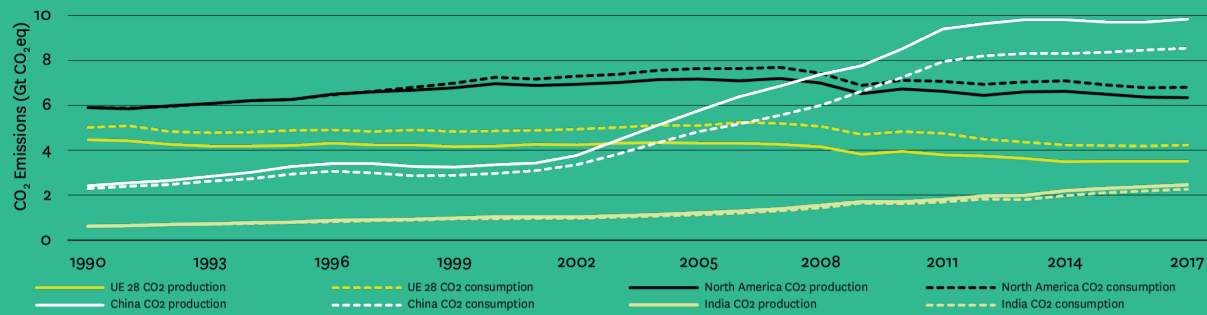
2. All GHG emissions except those related to land use, land-use change, and forestry (LULUCF) are accounted for. LULUCF is a convention used to establish national emission inventories provided to the United Nations Framework Convention on Climate Change.

*Other: trash + emission leakage + other burning of fuels.

4. EU-China Comparison: GHG Emissions by sector (2016)^{1*}



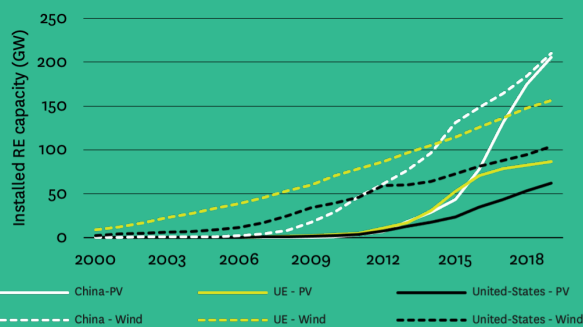
5. Change in Production-related CO₂ Emissions vs. Consumption-related CO₂ Emissions³



Production-related CO₂ emissions correspond to the CO₂ emitted within a given territory. Consumption-related CO₂ emissions take into account the CO₂ emitted within a given territory by adding the emissions from imports and subtracting the emissions from exports.

In China and India, production-related emissions are higher than consumption-related emissions, suggesting that both countries “export” some of the emissions generated within their territory (on the graph: *solid lines* above the *dotted lines*).

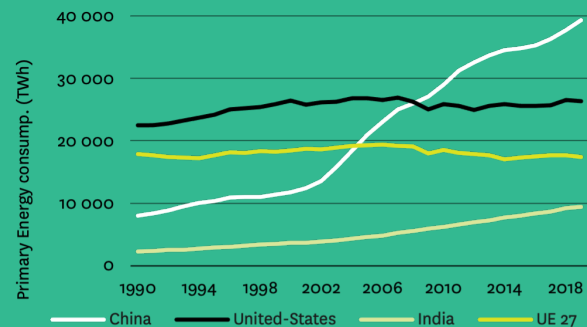
6. Unequal Growth of Renewable Energies⁴



China’s electricity mix (which is different from energy mix) is very coal intensive (65%) with slightly more than 30% of it being decarbonized (renewables and nuclear). This is in contrast to the European Union, which gets 65% of its electricity from decarbonized sources.

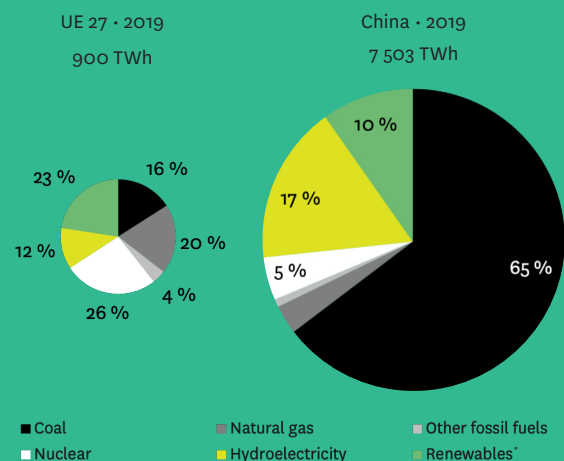
The EU began installing wind and photovoltaic capacity as early as the 2000s, but it was in the 2010s that capacity increased significantly. While still relatively limited in China until 2012, both technologies have expanded exponentially, with onshore wind capacity increasing threefold and PV capacity increasing twentyfold between 2015 and 2020. As of 2020, China has more than 270 GW of onshore wind and more than 250 GW of PV capacity, compared to 182 GW and 161 GW respectively in Europe. It is worth noting that since both technologies are intermittent, they can only produce electricity for a limited period of time. For example, in 2018, the load factor of onshore wind power in China was around 22%.

7. Primary Energy Consumption Evolution⁴



Primary energy is the complete range of unconverted energy products, either directly produced or imported. These are mainly crude oil, shale oil, natural gas, solid mineral fuels, biomass, solar radiation, hydraulic energy, wind energy, geothermal energy, and energy derived from uranium fission.

8. EU-China Comparison: Electricity Production by Fuel Type (2019)⁴



3. I4CE, 2020. From Global Carbon Budget 2019 and World Bank 2020.

4. BP Statistical Review, BP, 2020.

01



China's Climate Ambitions

What Role has China Played
in Climate Negotiations and
in Global Environmental and
Climate Geopolitics?

◀ **Boris Svartzman** • Franco-Argentinian filmmaker, photographer, and sociologist. Doctoral candidate at the Research Center on Modern and Contemporary China at EHESS (l'École des Hautes Études en Sciences Sociales) in Paris.
www.svartzman.com

Photo from the series "China in Change" / "Chine chamboulée" (2008).

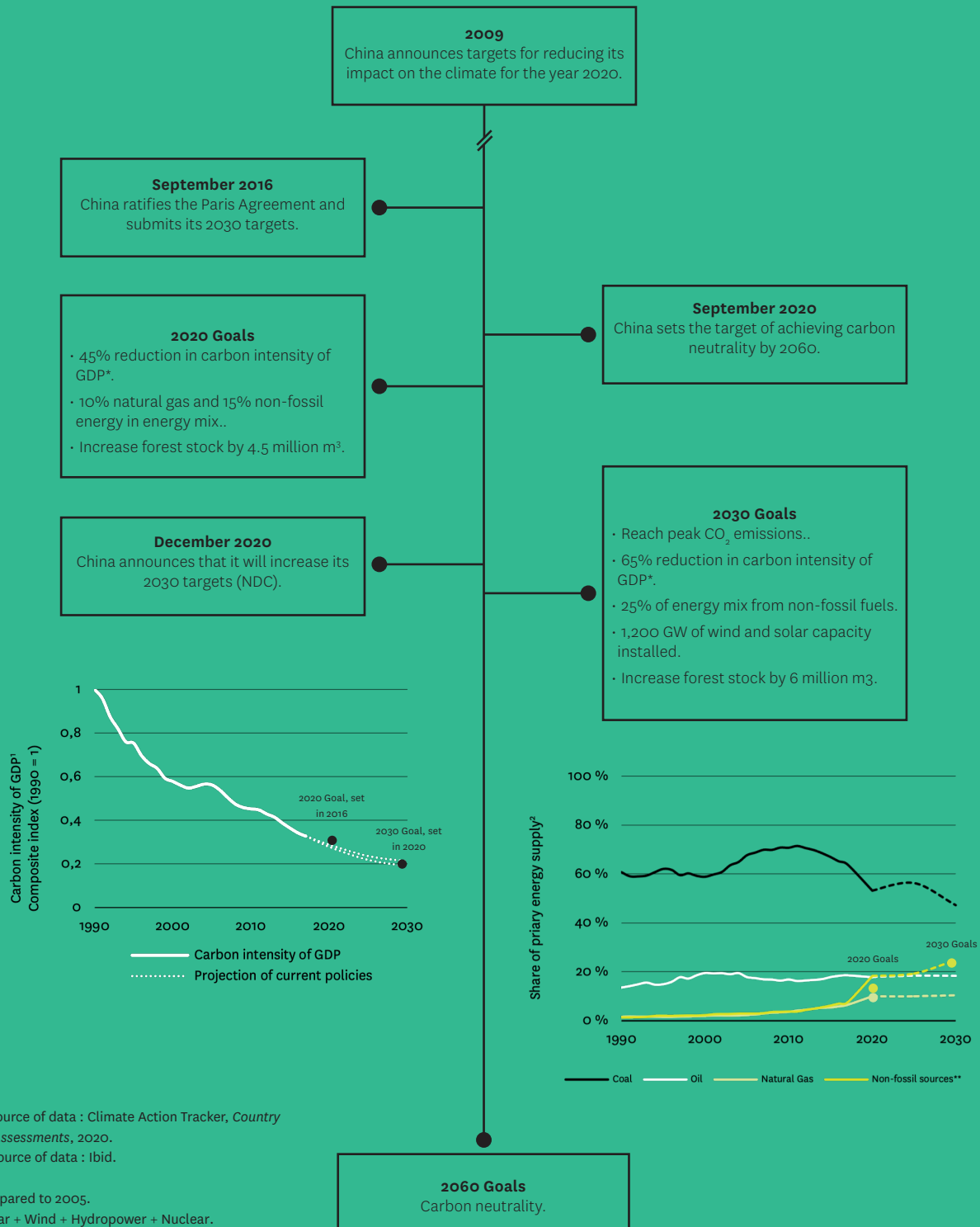


Amélie Latreille • GREEN Editorial committee

Léa Boudinet • GREEN Co-editor-in-chief

Clémence Pèlegri • GREEN Co-editor-in-chief

China's Climate Goals





Laurent Fabius • Former President of
COP 21 / Paris Agreement

Why COPs are Essential to Tackle the Climate Emergency

In 2015 and the following months, the Paris Agreement and the COP 21 that made it possible were the subject of widespread public support and a real movement of hope. As the Agreement was adopted, the acronym “COP”, which in international law is the generic term for the “Conference Of Parties”, bringing together all the States Parties to a Treaty, was transformed from an insider’s term into everyday language.

Since then, criticism against COPs have increased for not producing sufficient results, for being cumbersome and costly. Some even suggest that COPs should be replaced by agreements reserved for the major polluters (the G20) or by flexible meetings based solely on voluntary participation. They conclude that inter-state negotiation within the UN, the COP method, no longer works and that another approach is needed.

Paradoxically, criticism of the COPs by climate sceptics is sometimes echoed in some “pro-climate” circles. The arguments are obviously different: “We’ve had enough of summit meetings”, they say. “Stop the big meetings! We cannot expect anything from governments. It is up to the citizens themselves to act.” For them, the solution lies in what is known as “everyday ecology”, in “small gestures”, the sum of which, extended to the global level, would be better suited to obtaining the desired results. I am convinced that we need both. Controversy, or even opposition, between these two forms of action - global and local, collective and individual, governmental and citizen - seems vain. Progress involves “small gestures” and “big decisions”, often discussed in COPs.

In reality, the COPs are designed to hold each government and each player accountable to the world opinion over the long term. The periodic confrontation of all the actors of political, scientific and civil society, in the same

place, at the same time, for the same purpose, under the auspices of the UN and the critical gaze of international opinion, is certainly complex, but it seems indispensable. The major polluting countries and their leaders must be publicly held accountable for their global responsibilities. The smaller countries must also be heard, which would be impossible if, for example, the G20 alone were given the task of deciding on climate issues. The COPs set a course, a horizon, for action. They are also accelerators of decisions. Although each one is different, they all have in common that they make the public aware of the issue and strengthen the culture of the fight against climate change. Abolishing the COPs would be a gift to climate sceptics and opponents of multilateralism. In the face of this essential global problem, the COPs have the merit of putting pressure on all states to dialogue, evaluate and decide. It would be wrong to abandon them.

This is not to say that all COPs have been successful and that all their modalities have been exemplary: some have been disappointing, the most cited example being Copenhagen in 2009. However, each one has made a difference or at least reflected the reality of the situation in the eyes of the world. There is no recipe for success. At each COP, it is essential to set objectives that are accessible and understandable to as many people as possible. A five-year timetable for the COP programme - an important innovation - would allow for a better assessment of objectives and results.

To take the most recent examples, COP 20, in Lima in 2014, under the presidency of Manuel Pulgar Vidal, helped to prepare the Paris Conference in 2015 and set up the “Lima-Paris” agenda for action, thus bringing together the initiatives of States, local authorities and businesses in a single forum. COP 21, under my presidency, led to the “historic” Paris Agreement. COP 22 in Marrakech in 2016 usefully extended the Lima Agenda and the Paris results. COP 23 in Berlin and COP 24 in Katowice failed to raise the overall ambitions of states, but they did produce much of the rulebook for the Paris Agreement. COP 25 in Madrid, while it made some progress on the major issue of the oceans, was unable to raise the overall ambitions of the states, or to settle, as one might have hoped, the residual issues linked to the implementation regulations and referred to by specialists as “Article 6” (carbon markets) and “Article 8” (financing for loss and damage).

COP 26 to be held this year in Glasgow will be crucial. In particular, it will register the new nationally determined contributions (NDCs) of States, i.e. their commitments, which are expected to increase. It will mark the effective implementation of the Paris Agreement. Its priorities are the mobilisation of at least 100 billion dollars by developed countries to finance the ecological transition of developing countries, discussions on carbon market mechanisms and the countries’ adaptation plans to

the effects of climate change. It will need to be concerned with adaptation and not just mitigation. The Glasgow COP will show whether the post-Covid-19 economic recovery is moving us towards a low-carbon society or whether it is actually being abandoned. The pre-COP 26 and international meetings leading up to the conference will play a key role in this. The climate summit hosted by the United States on Earth Day, 22 April 2021, and the G7 and G20 summits chaired by the UK and Italy, will provide concrete incentives for action. COP 26 will strengthen the links between climate change, biodiversity and development goals. Concerning its format, it is essential that it can be held physically in order to facilitate negotiations. The success of Paris was only possible because of the trust built up with the participants on site and the informal discussions that took place right up to the last moment: the modalities of the negotiations certainly influence their

content.

The 2015 Paris Conference agreed on targets for combating global warming: we are not going to start over every year. They must now be implemented. The COPs must be maintained but must also evolve. For a long time, they were forums for negotiating objectives. They must now be more concerned with evaluating results, setting short, medium and long-term ambitions, and coordinating the actions of all partners, both public and private. In doing so, they pave the way for a new form of multilateralism that is universal, transparent, inclusive and open. A world in which global obligations, State commitments and civil society support coexist. In response to the urgent global challenge of climate change, carefully prepared, inclusive and ambitious COPs are essential to promote action.



Amy Dahan • Mathematician, historian and sociologist of sciences. Research Director emeritus, CNRS

How China's Position Has Evolved in the COPs and on the Global Climate Geopolitical Stage

Léa Boudinet & Clémence Pèlerin — How has China's position in climate geopolitics evolved over the past 30 years?¹

First of all, the term “climate geopolitics” is only gradually becoming established in the analysis of the climate issue. It did not exist in the 1990s, either at the Rio Earth Summit in 1992, or at the time of the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1994. At that time, the negotiations were North-North: developing countries were invited and participated in the multilateral process to “learn about the climate problem”, but they were not expected to make a formal commitment in the same way as the developed countries who had the historical responsibility for the problem.

The negotiation for the Kyoto Protocol focused on the distribution of greenhouse gas emission reductions among a small number of countries: the United States, Europe, Russia, Japan, Australia, and Canada. At that time, China was looking at the situation with some distance and was beginning to take an interest in the position of developing countries. It is important to keep in mind that as early as 1996-1997, the United States had stated that the American way of life was non-negotiable, and that it would not consider constraining its economic growth if the major developing countries, including China, did not do so either (the so-called Byrd-Hagel resolution of the US Senate). They anticipated very early on the peril, that is to say, the potential rivalry, that China represented for them, particularly from a demographic point of view. From the beginning, and there is a lot of evidence supporting this today, the United States did not want to make a commitment if other countries did not. The Democrats, with President Bill Clinton, signed the Kyoto Protocol in

1997; but as soon as President Bush was elected, they withdrew from the Kyoto Protocol. Throughout this period, China remained far removed from the multilateral process. The 1990s marked the beginning of China's unbridled opening up and industrialization, and on a global scale, to the explosion of trade and financial and liberal globalization. They are crucial, so to speak, in the acceleration of climate change. From 1995 to 2010, the nature of the climate issue has completely changed to become fully geopolitical. In 1992, I think that the global dimension of this issue was not clearly identified. It was generally considered a concern of mainly Western civilization and developed countries.

After the withdrawal of the United States from the Kyoto Protocol in 2002, the developing and emerging countries occupied the space left vacant by the Americans. It must be said that in the first decade of negotiations (1995-2005), the poorest countries were still relatively sceptical about climate change; they did not believe in the urgency of this problem. They themselves played a very minor role in the debates and were suspicious that this issue was being framed to limit their development. Many delegates from the poor countries of the South with whom I spoke between 2002 and 2004 told me that the language of numerical modelling is a “language of the North” which had its merits but is no longer sufficient. This statement is surprising and could be concerning. In fact, in the climate field, the method of models consists mainly in the numerical resolution of a mathematical problem of evolution (in the form of partial differential equations) whose initial state is fixed. However, when transferred and used within a political framework, the method erases the past and normalizes the present, which becomes a given and no longer needs to be questioned despite the heterogeneities and inequalities that it contains. In the Kyoto negotiations, the year 1990 is this starting point. Finally, the method globalizes the future. A molecule of CO₂ emitted anywhere on the planet, in the rice fields of Asia or on American highways, is accounted for in the same way. Needless to say, China did not hold this type of discourse and wanted to appear fully engaged in the scientific work of the IPCC².

From 2002 to 2009, a very gradual yet close alliance developed between the work of environmental NGOs, which immediately endorsed the scientific analyses of the IPCC, and the poor developing countries. Work was carried out to educate and explain the problem. However, in the absence of the United States, there was not much at stake in the negotiations. It was highly unlikely that an ambitious climate agreement could be reached without them. Europe has made some progress, such as when it adopted the 2°C threshold in 2002 following a major joint effort between scientists and politicians.

1. This interview was conducted in April 2021 in Paris.

2. A. Dahan, S. Aykut, *Gouverner le climat ? 20 ans de négociations internationales*, chap. 2, Presses de Sciences Po, 2015.

During the first decade of the 21st century, developing countries gradually changed their stance. They began to admit that climate change was real and that they would be the first victims. Indeed, climate disruptions were becoming more and more noticeable, and extreme events such as Hurricane Katrina in 2004 and the Indian Ocean tsunami in 2004 helped to change their perception. A number of delegates from developing countries, in particular Saleemul Huq from Bangladesh, who became the leader of the least developed countries, played a very important role in the negotiations, first by promoting the idea of adapting to climate change, and then the idea of “loss and damage” in 2013, until they tried to push for the more ambitious objective of a threshold (that must not be exceeded) of 1.5°C in the Paris Agreement.

Until 2009, China was therefore present but discreet: it was not the driving force behind the negotiations. During this period, it remained preoccupied above all with its own development and its historic double-digit growth. Let's remember that in 2007, China was expected to overtake the United States in terms of global emissions, whereas in the 1990s, it was expected to do so around 2030! In the language of the carbon market³ set up in the Kyoto Protocol - a gigantic, labyrinthine system made up of emission permits, accumulation criteria, economic compensation mechanisms, or clean development mechanisms (CDM) between the North and the South - China initially showed great reluctance towards arguments allowing industrialized countries to do nothing at home. However, its position changed dramatically when it realized the economic benefits that the CDM could bring: significant cash flow, investment support for projects that reduce CO₂ and other pollution, and above all, strategic technology transfer opportunities. In 2008, China was the first country to benefit from the CDM mechanism.

China, on the other hand, played a major role in what was called the “G77+China”, a coalition, in multilateral forums, first of 77 countries which then became a huge, heterogeneous conglomerate of 132 countries: developing countries of all sizes⁴, emerging countries, and even oil-producing countries. China nevertheless managed not to lose its influence or even its leadership over the G77, to avoid the strong hostility of the poor countries, by playing on alliances with the oil countries of the Middle East. India, on the other hand, was very tough in the negotiations. India insisted on equity issues and the historical responsibility of developed countries. It advocated for a

per capita carbon budget, whereas China has never defended such a position. Of course, China still had a much lower level of emissions per capita than developed countries, but it probably anticipated that this would not last.

How do you interpret the turning point that the Copenhagen COP represents, both for global climate negotiations and China's position?

It was only in Copenhagen that China appeared as a crucial power, both in globalization and in climate governance, at the forefront of the negotiations, and that we clearly understood that the major geopolitical divisions had shifted. Negotiations became North-South, dominated by the US-China rivalry.

In the weeks leading up to the COP 15, there was a real excitement, a hope to change the world, especially as youth and civil society movements were beginning to emerge. It was also the first year of Obama's presidency. The COP poured cold water on these hopes. Nothing happened during the negotiations. The Danish president was dealt a harsh blow and everything was discussed in the hotels between Obama and the Chinese president Hu Jintao. But in Copenhagen, the Chinese teamed up with the other emerging countries; with Brazil, India, and South Africa. It formed a distinct and cohesive group (the BASIC) always involved in discussions with President Obama. Whereas on the American side, for both Democrats and Republicans, the official stance has been one of political continuity, refusing to accept the American commitment without reciprocal obligations on the part of the other parties involved. Today we know that China is not opposed to the multilateral process. In a way, it accepts it; it has never wanted to withdraw from agreements. On the contrary, it has played the card of a very important and responsible power that does not leave the negotiating table. Like the United States, it did not want a major binding treaty yet it finally embraced the idea of a voluntary and inclusive agreement.

The following year, in Cancun (December 2010), many feared that the multilateral process itself would be called into question. Europe had been dealt a serious blow and was out of the game. The multilateral process was saved by the least developed countries, which are viscerally attached to this process because it is the only arena that puts them on equal footing with other States. An extremely subtle and skilful political game was played by the Mexican presidency while Europe was on the ropes and the United States was not in a position to really advance the negotiations. China was always in the background, as if it were trying to be forgotten.

In 2011, in Durban, there was a desire to resume negotiations on a more “bottom-up” basis, based on voluntary contributions country by country. This gave rise to a me-

3. A. Dahan, S. Aykut, op. cit., chap. 3.

4. Among the developing countries as a whole, several very active sub-groups have organized themselves autonomously; let us mention the Least Developed Countries (LDCs, about fifty of which 34 are in Africa, 9 in Asia, 5 in the Pacific, 1 in the Caribbean), the small island states (AOSIS, about forty) and, since 2005, a coalition created on the initiative of Papua New Guinea of countries with riverine forests, whose objective is to obtain recognition of the efforts deployed by developing countries to slow down the emissions due to deforestation. See A. Dahan, S. Aykut, op. cit. chapter 6.

morale tug of war between India, who was very unpromising in its position, and a Europe full of political goodwill, with China still in the background. A dispute broke out when the Bangladeshi delegation accused India of neglecting the climate threat and the risk of sea level rise threatening Bangladesh, and ultimately of allowing a dramatic situation to continue. Faced with this ultimatum, India capitulated.

Alongside the COPs, where its position is more in the background, China plays a very important role within the IPCC. It has high-level scientists who have had important responsibilities in the preparation and coordination of IPCC reports since the 2010s. It has its own global climate model - in total there are 23 in the world, and France has two - and participates in the scientific community in model comparison exercises. In the ratification sessions of the IPCC reports, which are highly political, the delegations of each country discuss the content of the summaries for the decision-makers. It is interesting to note that China, which is present at these meetings, maintains a relatively scientific point of view. It does not object to the wording like the oil producing countries do almost systematically and which act as incredibly obstructionist forces. On the whole, China's attitude is not obstructionist.

Can you go back to the special timing of the Paris Agreement and its preparation?

In the 2011-2015 preparation period for the Paris Agreement, the second Rio Earth Summit took place in June 2012. While climate had become the major environmental and geopolitical issue, and China, alongside the host country (Brazil) played a very important role in the preparation and running of this Earth Summit, I was struck that this issue was simply absent from the negotiations or as a central element of the Earth Summit. It was an absolutely astonishing moment 20 years after the rise of the notion of sustainable development and the multilateral process launched in 1992. This 2012 summit was intended to take stock of developing countries' sustainable development. The vast majority of these countries prioritized fighting poverty, access to drinking water, health... but the climate problem was almost absent from this list and the emerging bloc led by China had contributed to this oversight⁵.

In Rio in 2012, Europe was still far from being in a strong position. Its idea of a new world environmental organization was a failure. The financial crisis of 2008 and the dismal results of Copenhagen had weakened it and it appeared to be lagging behind the United States on the one hand and this emerging bloc on the other.

Between 2012 and 2015, the negotiators accomplished an enormous amount of work to achieve the result that was the Paris Agreement. In addition, from 2013 onward,

the Chinese economy entered a new stage of development. The issue of pollution became particularly prevalent, deeply worrying the urban Chinese population, and the state was forced to address it. In autumn 2014, during Barack Obama's trip to China, a joint declaration sent the signal that the two powers were willing to go further and find a way out of this stalled process.

At that time, many philanthropic financial organizations, think-tanks, and NGOs wanted the Paris Agreement to happen and they acted on state delegations, particularly from developing and emerging countries, but also among US political staff, to make them change their mind. It was a very important performative move and the presence of these actors was reinforced during the three preparatory meetings for the Paris Agreement held in Bonn⁶.

GREEN: Did China adopt a particular position towards other developing countries during the preparation of the Paris Agreement?

The poorest countries organized amongst themselves to push their own agenda for Paris in favor of a more ambitious scenario than the 2°C threshold, pushing the issues of adaptation and financial aid to the most vulnerable countries. These countries were sometimes perceived by developed countries as potentially on the side of obstructive forces or Russia – countries that still needed to be convinced to join the collective effort. In fact, and to the surprise of the developed countries, a few days before the signing of the agreement, the developing countries collectively expressed their willingness to endorse the 1.5°C warming target, or else they would not sign the agreement. However, on the sidelines of the negotiations, many scientists stated that they did not believe that this target was feasible, and that 2°C was already a very ambitious course. I myself wrote, following its adoption, that it reinforced the schism in the reality between governance and ongoing climate change by announcing targets that ran counter to the world's climate reality⁷. I don't know if I was wrong, but emissions have continued to rise. China has stayed out of this controversy.

The general idea finally retained during the negotiations was to include in the text a sentence concerning the threshold ("not to be exceeded") of 2°C and, if possible, 1.5°C, and to ask the IPCC to write a report on the feasibility of 1.5°C. From the outset this idea did not enjoy consensus, both among scientists and in various delegations, but the momentum of the negotiations and the desire to sign a historic agreement finally led to the adoption of this language. Very quickly, in 2016, the IPCC produced a report changing the focus of the demand a bit, showing that a world at +1.5°C of warming was already terribly dan-

6. E. Morena, "The Price of Climate Action: Philanthropic Foundations in the International Climate Debate", Palgrave Macmillan, 2017.

7. A. Dahan, "La gouvernance climatique: entre climatisation du monde et schisme de réalité", L'Homme et la Société, no 199, p 79-90, 2016.

5. A. Dahan, S. Aykut, op. cit., chap. 7.

gerous and that +2°C would be much more so. In short, that every half degree counts. Moreover, while the IPCC had always maintained its historical “policy-relevant” rather than “policy-prescriptive” posture, staying away from political solutions, it adopted an innovative methodology for the 1.5°C Report. It made the scientists of the three groups work jointly and interactively in a search for more concrete climate solutions and policies.

At COP 21, it was unthinkable to have an agreement without China, as it was already the world’s largest emitter. It did not commit to reducing its emissions by 2030. On the contrary, it stated that it would increase its emissions to continue its growth and lift its country out of poverty. On the other hand, it has committed to reducing the carbon intensity of its economy. But every country reduces the carbon intensity of its economy as it grows, mainly because of innovation and technological progress and the increasing of service-based activities. This was not a very risky commitment on China’s part.

In general, before or after Paris, China, like the United States and the other major players in multilateral governance, has always worked to ensure that the issue of fossil fuel extraction and fossil fuel subsidies remains unaddressed in the negotiations.

GREEN: How do you interpret the idea of ecological civilization in relation to China? How does this idea influence China’s development model?

Since 2008, I have noticed that China has always been very reluctant to accept the rhetoric of “sustainable development”, which is fundamentally associated with a social-democratic project derived from Western utopias of the 1980s. Chinese leaders or officials have preferred to evoke (as early as 2008) a “low-carbon society”, in which the technological dimension is central: alternative technologies to fossil energies and their associated techniques, technological innovations of new industrial processes (based on ammonia, nitrogen, hydrogen, etc.) allowing CO₂ emissions to be avoided. The economic and material development of China is not really that of a civilization that would like to be ecological, close to Nature, respectful of resources, balances, and natural rhythms. It has, on the contrary, favored urban growth in all directions, and a very unequal society. China has a middle class (from 3 to 400 million inhabitants) whose level of per capita emissions is comparable to that of the United States. China has developed by covering vast areas of arable land with concrete, by promoting a frantic consumption model. The Chinese population remains fascinated by and attracted to the Western way of life, especially from the point of view of food. In this case, the government is trying to react to the rapid growth of obesity, and fortunately Chinese cultural traditions remain very strong. So the die is not

yet cast on this side.

It should be noted that China is actively promoting reforestation as an offset policy to achieve carbon neutrality. However, the results of this policy must be considered very carefully, both from a climate and environmental point of view. There have also been some very disturbing recent announcements of geoengineering: changing rainfall, diverting clouds, or diverting rivers flowing down from the Himalayas. China is too powerful, often brutal, and lacks much transparency and respect for individual rights not to fear the actions of the sorcerers’ apprentice.

Today, China is investing in various multilateral arenas such as the Food and Agriculture Organization (FAO), which it heads. This shows its great interest in these issues, in the agricultural resources it so badly needs, even as it continues to develop intensive farming methods. In the White Paper (written by China within this framework) on international cooperation, the aim is to distance itself from previous North-South models of cooperation and to show that China, as the largest developing country, has a natural legitimacy to dialogue with other developing countries. The discourse remains very focused on production: a lot of fertilizers, phytosanitary products, pesticides, and insecticides. The book advocates monitoring by drones, the use of new technologies, and new geographic information systems. In short, agribusiness must help African countries to escape from poverty, and the FAO wants to play the role of intermediary between States and private investors. I do not see any particular reference here to agro-ecology or to the virtues of an ecological transition.

Many of China’s contemporary development trajectories seem quite contrary to the idea of an ecological civilization.

What about the place of ecology in China’s power politics today?

In the fight against climate change, China is promoting the potential of technology and innovation to solve the climate crisis. This is, of course, political rhetoric and the underlying quest for industrial and technological competitiveness seems obvious. I have reservations about the feasibility of China’s 2060 carbon neutrality commitments. When you consider that 60% of China’s electricity comes from coal, and that decarbonized sources of generation only account for 13% of electricity production, you can’t help but think that this is not going fast enough.

Overseas, in Indonesia for example, China continues to export both coal-fired power plants and renewable energy, including solar photovoltaics. And the New Silk Roads project was not conceived as an ecological development project, but as an economic expansion and trade one.

For Europe, it is not a question of wanting to declare an economic war on China. There is room for mutual interest and certain investments. But we should not be naïve either. It is in Europe's interest to strengthen its unity with China. To a certain extent, the United States has a very pragmatic understanding of its economic interests and does not give in to either China or Europe.

GREEN: How do you perceive the dynamics between Europe and China about the climate issue?

Europe has an important relationship to develop with Africa because of its geographical proximity and the linguistic links that exist with many African countries; and it probably does not devote enough resources to it. China is now much more aggressive and effective in this area. However, the African continent plays a crucial role in the global climate equilibrium and therefore in the fight against climate change. Demographers predict a population of 2.5 billion people there in 2050.

Let us remember that in China, the massive displacement of the population, the productivist model, the capacity to create jobs to ensure social stability, industrial waste and replication (1,200 coal plants!), the conversion of land, etc.—all these factors of Chinese growth that have driven not only energy choices but also social inequalities, have been decided since the 1980s and have been linked to Chinese regional political economies. For the climate, time is running out on the African continent as elsewhere. Africa is the only part of the world whose development is still largely in the future, and which potentially has a lot of natural wealth, sunshine, and oil reserves (very unevenly distributed). Land use is still very poorly managed: There are low land yields, burning of biomass, droughts and deforestation, the uncontrolled and polluting development of cities, and huge pockets of poverty. Without pretending to tell Africans what to do, an intensification of Europe-Africa initiatives must take place on renewable energies and access to energy to optimize land use between the various demands of food security, climate and development, or programs for access to education, etc. Developing innovative paths to development for Africa, different from the environmentally destructive paths we

have taken in the West, is a strategic challenge for climate stabilization in the second half of the 21st century that Europe must seize.

Another major problem is the agreement signed on December 30th between the EU and China which anticipates a vast trade and investment treaty. This agreement seems likely to inevitably weaken the European structure — Germany is the main winner in Europe — because China has always acted by playing on rivalries and economic competition between countries. Moreover, it provides no real guarantee of loyalty and transparency in its commitments to investors on its soil, not to mention its authoritarian behavior towards popular liberation movements (the Uyghurs, Hong Kong, Taiwan ...). This agreement shows above all the EU's lack of geostrategic vision, which had the possibility of positioning itself as the third strategic force between the United States and China as the guardian of both democratic freedoms and the climate cause⁸.

Today, Europe must approach the idea of ecological civilization in a more practical way. We must not fool ourselves. We will not be able to live in the same way, consuming as much and imagining that we can substitute everything for everything: renewables for coal, ammonia for carbon, hydrogen for petroleum. I do not believe that this is realistic; we need to cultivate another vision, intellectually and culturally, and make it emerge in society. To do this, it is necessary to integrate technical issues and cultural projects. The Chinese model is not and cannot be the European model.

I am personally upset by the fact that in Europe, we (intellectuals, NGOs, social movements) have been unable for the moment to work out a vision of the future, one that is rich and multifaceted, as far removed as possible from the mindset of reducing growth and collapse thinking on the one hand, and from all-technology pure technological thinking on the other. It seems to me that we have not yet succeeded in making the fight against climate change a societal, cultural, political, and economically plausible endeavor in order to make it attractive in the public debate, and capable of bringing on board the majority of people.

8. See also: AITEC, ATTAC, "Note de décryptage de l'Accord", 2021.



Thibaud Voïta • Has been working on climate and energy issues for 15 years. He lived and worked in Beijing for several years and dedicated his PhD to China's energy policies

Economic Growth and Climate Change — Beijing's Hard Choices

18

China's emergence as a global economic power in recent years was accompanied by a growing role on the global climate stage. But this was not necessarily obvious since the fight against climate change has not always been one of Beijing's priorities and may even appear to contradict its national objectives.

First, in terms of growth, China's emergence as the world's second largest economic power (and probably the first within the next few years) was only possible through an impressive increase in its energy consumption, and more specifically through coal, which remains by far the dominant source in the country's energy mix with a little less than 60 %¹. At the same time that its economy was growing, its greenhouse gas (GHG) emissions reached record level and by 2004, China had become the world's largest emitter². But in the second half of the 2000s, faced with the environmental and climatic consequences of its growth and energy security pressures, Beijing had to start massively investing in clean energy, renewables, and energy efficiency, which created a huge market for its companies, both nationally and internationally. Then, in the first half of the 2010s, China actively worked to join the Paris Agreement.

Yet at the same time, since the 2000s, China showed a significant acceleration in its foreign investment, particularly by companies in the fossil fuel sector and by constructing coal-fired power plants in various countries. But China is struggling to overcome this addiction : the equivalent of nearly 247 GW of coal-fired power plants (which is enough to supply Germany with electricity) are currently under construction, compared with the closure

of only 9 GW^{3,4}.

This paper aims at showing how China is being forced to move forward on climate issues, despite conflicting pressures arising primarily from economic growth.

China as a major climate player

Since 2004, Beijing has been the world's largest GHG emitter, the United States. While its emissions seemed to have plateaued in 2013-2014, hovering around 9.80 gigatonnes emitted per year, they rose again in 2017, up to 9.84 gigatonnes, and have continued to rise ever since. In comparison, that same year 2017, total global emissions amounted to 34.74 gigatonnes, with the second largest emitter, the United States, accounting for 5.27 gigatonnes⁵. In addition, the 2020 respite related to the Covid-19 crisis and the freeze of certain activities has proved very brief. At the beginning of 2021, we learned that Chinese emissions were quick pick up again, rising by 4 % in the second half of 2020, which is an increase by 1.5 % compared to the total emissions of 2019⁶. All in all, China emits just under 30% of the planet's total GHG emissions.

In recent history, there certainly have been some modest yet numerous signs of political will to tackle this problem in an increasingly direct manner. During the first half of the 2000s, Beijing studied the possibility of calculating its green GDP, that is to say the traditional GDP from which losses related to environmental damage would be subtracted⁷. Despite several efforts in this direction, the project remained dormant until the announcement 15 years later, in June 2021, by the city of Shenzhen that it was adopting an equivalent indicator. This "Gross Ecosystem Product" includes 19 indicators related to natural ecosystems (forests, wetlands, oceans, etc.) and artificial ecosystems (farms, pastures, etc.)⁸.

The 2000s have nevertheless seen the growing importance of climate issues, addressed in particular in terms of improving energy efficiency and as a way of responding to energy security concerns. The various Five-year plans were initially – starting with the 11th plan from 2006 to 2011 – given energy intensity targets, meaning energy consumed per unit of GDP produced. This in itself is only indirectly linked to a reduction in emissions as it does not imply a reduction in energy consumption or the use of decarbonized energy sources. Then, in 2011, the Five-Year Plan included a carbon intensity reduction target – which

1. Reuters Staff, "Coal's share of China energy mix falls to 57.7% in 2019 – stats bureau" Reuters, 2020.

2. "How is China Managing its Greenhouse Gas Emissions", China Power, 2018, updated in August 2020.

3. Global Energy Monitor, Sierra Club, CREA et al. "Boom and Bust 2021. Tracking the Global Coal Plant Pipeline" Global Energy Monitor, 2021.

4. "Analysis : China's CO₂ emissions surged 4% in second half of 2020", Carbon Brief, 2021.

5. China Power, op. cit ; [ndlr] see also the Infography titled "Preface: Chinese Statistics", page 6.

6. Carbon Brief, op. cit.

7. "Le PIB vert, si proche et si lointain", China Analysis, Asia Centre, n°9, 2006.

8. "China's tech hub Shenzhen moves ahead with GDP alternative that measures value of ecosystem goods and services", South China Morning Post, 2021.

is also not a guarantee of absolute GHG reduction – which would be supplemented by new absolute targets in 2016 (see Table 1). The protection of the environment has even appeared in political thought with the emergence of the concept of “ecological civilisation” (which is vague in theoretical and political terms), enshrined in the 2012 Constitution of the Chinese Party which advocates cooperation on climate change and the acceleration of the energy transition⁹.

TABLE 1 • CARBON INTENSITY REDUCTION OBJECTIVES IN PREVIOUS CHINESE FIVE-YEAR PLANS¹⁰

	12 th five-year plan 2011 - 2015	13 th five-year plan 2016 - 2020	14 th five-year plan 2021 - 2025
Reduction of GDP's carbon intensity	17 %	18 %	18%
Reduction of GDP's energy intensity	16%	15%	13,5%
% of non-fossil primary energy consumption	11,4%	15%	20%

At the international level, China waited until the 2010s to establish itself as a driving force in climate negotiations. As a result, the 2000s ended badly for Beijing, following the failure of the United Nations Climate Conference held in Copenhagen in 2009 (COP 15) where China was singled out for its lack of cooperation¹¹. Things started to change as the COP 21 approached, especially thanks to the work done with the Obama administration. A first agreement between the two countries on reducing greenhouse gases before the COP 20 in 2014 allowed the emergence of a new Chinese-American leadership on the matter and sent a very strong international signal, which culminated in the signing of the Paris Agreement in December 2015¹². Unfortunately, the election of Donald Trump and the announcement of the United States' withdrawal from the Paris Agreement strained the partnership. During the Trump era, China played a more ambiguous role, despite participating in several initiatives that allowed the country to reaffirm its role with respect to climate change on the international stage: a ministerial summit with Canada and the EU in September 2017, participation and presence of Xie Zhenhua at the Global Climate Action Summit in San Francisco in 2018 (organised by Jerry Brown, then Gover-

nor of California, and not by the federal government), participation in the UN Climate Summit in 2019 where China was the shared leadership of an initiative on nature-based solutions (such as reforestation or prairies and wetlands extension)¹³. In addition, China is set to host a UN summit on biodiversity in Kunming in autumn 2021 (the summit was initially planned for 2020, but it has been postponed due to the Covid-19 pandemic).

If many hope that the European Union will carry the torch left by Obama and work with China on climate issues, the latter has tempered Brussels' ambitions and has made it clear that climate cooperation comes after other priority issues. And so, China only agreed to a joint climate declaration with the EU after the recognition of its market economy status, which will push this declaration's finalization back by one year¹⁴. China is also taking a more aggressive position in climate negotiations, sometimes returning to positions that were believed to have been abandoned in favour of the “spirit of Paris” that made the COP 21 successful. In particular, China once again started to use the “shared but different responsibility” principle, which stipulates that developed countries with the largest accumulated carbon footprint must increase their support to developing countries (including China) in the fight against climate change¹⁵.

The election of Joe Biden and the return of the United States to the climate stage has changed the deal once again. It is still too early to assess China's potential readjustment, but it is interesting to note that very shortly after Biden's election and John Kerry's appointment as special envoy on climate, Chinese negotiator Xie Zhenhua came out of retirement to resume his duties¹⁶. Xie had worked with Kerry in preparing the Paris Agreement, and this is the second time he has returned to his former role when he was supposed to be retired. The fact remains that the first exchanges between the two old acquaintances and their respective administrations have not led to any definitive results¹⁷. In any event, it should be noted that the EU is struggling to establish a privileged relationship with Beijing, who remains more receptive to Washington's calls.

Climate pragmatism and diverging priorities

China's position remains equally complex at the national level, with the fight against climate change still subject to growth demands. During the Maoist era, strongly in-

9. H. Wang-Kaeding, “What does Xi Jinping's New Phrase ‘Ecological Civilization’ Mean”, *The Diplomat*, 2018.

10. Objectives are set compared to 2005 levels.

11. “How do I know China wrecked the Copenhagen deal? I was in the room”, *The Guardian*, 2009.

12. “Changement climatique : la Chine règne-t-elle désormais sur les COP ?” *Asialyst*, 2017.

13. Reuters Staff, “China to tackle climate change with ‘nature-based solutions’”, *Reuters*, 2019.

14. T. Voita, “4 défis que devra relever la Chine pour être un partenaire fiable dans la lutte contre le changement climatique”, *Huffington Post*, 2018.

15. Ibid et *Asialyst*, op. cit.

16. “Climate veteran Xie Zhenhua returns as China's special envoy”, *Climate Home News*, 2021.

17. “Big thing : The fraught US – China climate relationship”, *Axios Generate*, 2021.

fluenced by the Soviet Union, China sought to use nature and its resources to develop its manufacturing base. This trend accelerated with the country's growth in the 1980s. And so, the country developed without really considering the impact of its growth on the environment and even less so on the climate, relying on its coal reserves and developing its heavy industry. The question now in the early 2020s is whether the country's growth targets can really be compatible with the 2030 peak in GHG emissions or the carbon neutrality announced for 2060. However, the new Five-year plan, which spans the first half of the decade, must still be clarified and does not answer these questions at the time of writing. Experts differ on how to interpret the new Chinese objectives especially since, in 2020¹⁸, China still has the equivalent of 247 GW of coal-fired power plants under construction – more than the total capacity of the United States – which will make it difficult to achieve these carbon targets¹⁹.

Not surprisingly, Beijing's development-centered policy creates tensions and disagreements within the government itself and sometimes forces leaders to walk a fine line. First, environmental or climate issues can threaten social order as was seen in the 2000s with the increase in protest movements concerning the pollution of rivers and lakes, or at the unprecedented degradation of air quality²⁰. More recently, in 2019, major (and rare) demonstrations were held in the city of Wuhan to protest against plans for a waste incineration plant²¹. However, the country needs to maintain rapid growth in order to keep absorbing the number of young graduates entering the labour market, and more generally to maintain social peace.

The government is therefore faced with the daunting task of continuing to promote growth while preserving the climate. This leads to, among other things, measures aiming at achieving "green growth", which include support for so-called green technologies: renewable energy, electric vehicles, carbon sequestration, etc. Nevertheless, consensus on these topics is only superficial and can sometimes show cracks, as this was seen with former finance minister Lou Jiwei, who recently and publicly expressed concern about the impact of environmental reforms on the country's growth. His concerns are strongly echoed by local governments, which are sometimes reluctant to implement the guidelines coming from Beijing²².

These contradictions are also reflected in foreign policy. China has placed the principle of non-interference at the centre of its foreign relations and, unfortunately, climate issues do not seem to be an exception this rule²³. And so, through its New Silk Roads initiative, Beijing can sell both wind turbines and coal-fired power plants, as it does to countries such as Pakistan as well as at the EU's doors, which is not without concern for Brussels²⁴.

An impossible position in the long term?

The fact remains that the world is changing, climate change is accelerating, and China's attitudes, inherited from recent decades, are increasingly difficult to maintain. We mentioned the negative impact of COP 15's failure. This trend could accelerate. Last September, China responded by announcing a target to be carbon neutral by 2060, and the country is also actively seeking to reduce its dependence on coal. Beyond these announcements, the country's evolving institutions could mark the beginning of a paradigm shift. For example, in 2019, we saw the strengthening of the Ministry of the Environment (renamed Ministry of Ecology and Environment, MEE) at the expense of the all-powerful National Development and Reform Commission (NRDC)²⁵. In addition, the MEE recently published a blacklist of the most polluting projects of the New Silk Roads initiative, calling on Chinese banks to no longer support investments in these projects. Some see this as a sign of a possible ban on foreign investment in coal²⁶. Finally, if there are currently no youth movements in China similar to Fridays for Future, protests could increase in the future as the effects of climate change start to be felt²⁷.

China's national and international climate positions can appear perplexing. Based on its announcements, we could think that Beijing is accelerating the fight against climate change. However, the reality seems much more ambiguous as leaders try to reconcile the seemingly divergent, or even contradictory, objectives of promoting a low-carbon society while maintaining strong economic growth, maintaining low unemployment and enriching the population, all in order to maintain social peace. If Beijing manages to reconcile these objectives, then it will have succeeded in solving the seemingly impossible equation of green growth.

18. "Q&A : What does China's 14th 'five year plan' mean for climate change?", Carbon Brief, 2021.

19. Global Energy Monitor (GEM), Centre for Research on Energy and Clean Air (CREA) "China Dominates 2020 Coal Plant Development", Briefing, 2021.

20. See also "China blames growing social unrest on angst over pollution", The Guardian, 2007 ; Y. Deng, G. Yang, "Pollution and Protest in China : Environmental Mobilization in Context", The China Quarterly, 2013.

21. "China has made major progress on air pollution. Wuhan protests show there's still a long way to go", CNN, 2019.

22. M. Velinski, "China's Ambiguous Positions on Climate and Coal", Éditoriaux de l'IFRI, 2019.

23. K.S. Gallagher, R. Bhandary et al., "Banking on coal? Drivers of demand for Chinese overseas investments in coal in Bangladesh, India, Indonesia and Vietnam", Energy Research & Social Science, 71, 2021.

24. "China pivots to old ally Pakistan for coal after Australia spat", Nikkei Asia, 2020 ; "Why the Balkans is struggling to kick coal", China Dialogue, 2020.

25. M. Velinski, op. cit.

26. "Belt and Road pollution blacklist discourages fossil fuel investments", Financial Times, 2020 ; "China's environment ministry floats 'ban' on coal investment abroad", Climate Home News, 2020.

27. Only one activist, Howey Ou, is officially part of the movement. See "Einsame Aktivistin in China gibt nicht auf", Energie Zukunft, 2020.



Jean-Paul Maréchal • Senior researcher in economics at Université de Paris Saclay, deputy director of IDEST (Institute of law, space and telecommunication) and associate researcher, Asia programme at INALCO

China's Climate Realpolitik

On 4th December 2012, during Doha's COP 18, an article summarising Beijing's position regarding climate change was published in the online China Daily. It stated that "according to one wealthy country responsible for huge amounts of greenhouse gases emissions that has yet to sign on to make binding cuts, there is no rich-poor divide in emissions obligations. As usual, the United States has challenged the principle of 'common but differentiated responsibilities' during climate change talks in Doha, Qatar, saying that the future agreement on coping with climate change should be based on 'real-world' considerations and should not specify different responsibilities for rich and poor countries. But this really depends on what kind of real world the US is living in." The author later went on to explain that "between developed and developing nations, there is a world of difference. That's why equality can only be realized when different players bear obligations in line with their capacities.", before reminding that "at the Durban Climate Conference in 2011, Xie Zhenhua, the head of the Chinese delegation, expressed the country's willingness to discuss binding emissions cuts after 2020."¹

Five years later, at the 2017 Davos Forum, two months after Donald Trump's victory, Xi Jinping insisted that the countries who had signed the Paris Agreement should "stick" to the agreement "instead of walking away from it". That same month, Xie Zhenhua stated that his country was "capable of taking a leadership role in combating global climate change"². On October 18th of the same year, during the CCP's 19th Congress, Xi Jinping declared that, "What we are doing today to build an ecological civilization will benefit generations of Chinese to come. We should have a strong commitment to socialist ecological civilization and work to develop a new model of moderni-

zation with humans developing in harmony with nature. Our generation must do its share to protect the environment."³

In the meantime, Xi Jinping and Barack Obama had met in Beijing in November 2014 at the Asia-Pacific Economic Cooperation (APEC) Forum, during which the two presidents issued a joint statement on the fight against climate change. The Chinese president stated China's intent to reach peak CO₂ emissions around 2030 and to make every effort to achieve it before then. The US president had claimed that by 2025, the US would reduce its emissions by 25 % to 28 % from 2005 levels and that it would do its utmost to reach 28 %. A year later, all of this would be included in the Paris Agreement (2015).

Are the Chinese really changing direction? And how much credit should be given to Beijing's (relatively recent) commitments? Among the many reasons that could explain the Chinese government's change of attitude towards the fight against global warming, there are three that seem particularly important to us. They are, respectively, socio-environmental (1), economic (2) and diplomatic (3) the problems observed and the measures taken in each of these areas tend to reinforce one another. Hence the commitments that were made, especially at an international level, whose truly binding nature is questionable (4).

Socio-environmental reasons

Since the beginning of the reforms initiated in 1978, China has experienced dramatic economic growth. In fact, between 1980 and 2017, China's GDP (including Hong Kong) rose from 395.7 to 10,441.4 billion dollars (2010) which represents a 26.4-fold increase. In constant yuan terms, it was multiplied by 28.9⁴. At the same time, GDP per capita increased 18.6-fold, rising from \$401.10 to \$7,491.30. Such an economic boom over such a long period of time was only possible because of energy consumption that is without precedent in the country's economic history. Total primary energy demand went from 602 million tons of oil equivalent in 1980 to 3,077 million in 2017 – a little more than a 5-fold increase⁵. Fossil fuels – and especially coal – have been, and still are, heavily used to reach such levels of production (Figure 1).

This has led to an explosion in Chinese CO₂ emissions from 789.4 million tons in 1971, to 2.12 billion in 1990, and 9.3 billion in 2017⁶. Such levels of emissions have brought about both a deterioration in air quality - and thus strong public discontent - and a growing awareness from the authorities regarding the dangers of climate change.

1. "Welcome to real world of climate change", China Daily, 2012.

2. "No cooling", The Economist, 2017.

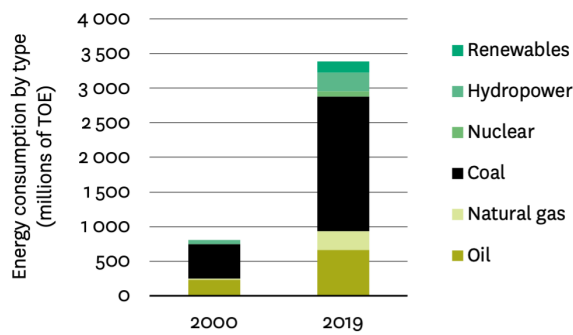
3. Full report of Xi Jinping at the 19th National CCP Congress.

4. World Bank, OCDE, "*PIB par habitants (unités de devises locales constantes)*", consulted on January, 26th 2021.

5. IEA, "*CO₂ Emissions From Fuel Combustion. Highlights*", 2019.

6. Ibid.

FIGURE 1 • CHINA'S ENERGY CONSUMPTION BY TYPE AND ENERGY MIX IN 2000 AND 2019⁷



The first phenomenon - the degradation of air quality - is often summarised with a neologism, “airpocalypse”, which appeared in the 2000s to refer to the record levels of pollution observed in major Chinese cities. The main pollutants affecting the well-being of city residents are nitrogen oxides (NO_x), sulphur dioxide (SO₂), carbon monoxide (CO), heavy metals (arsenic, cadmium, etc.) present in coal combustion ashes, etc. In 2009, 19 out of the 36 cities in the world with the highest levels of pollution from particles with 10 micrometers or less in diameter (PM₁₀) were in China – including Xian, Tianjin, Harbin and Shanghai. In early 2013, for instance, a spike in pollution hit Beijing for three days⁸. On January 11th, the levels of PM 2.5 in some parts of the city reached 993 micrograms per cubic metre, i.e. approximately 40 times more than the WHO standard, which estimates that being exposed to levels above 25 micrograms for more than three days per year is harmful to health⁹. These pollution levels generated such strong frustration that the authorities responded to public pressure by finally agreeing to publish air quality data for Beijing in 2012 and for 74 other cities the following year¹⁰. The fact that the Chinese authorities asked the meteorological station at the American Embassy in Beijing to stop publishing pollution alerts in 2012 because the practice was deemed to be an interference in Chinese domestic politics, is very revealing of the extent of the issues at stake¹¹. The same year, an MIT study estimated the cost of air pollution in China at \$112 billion (at their 1997 value), whereas it was \$22 billion in 1975¹².

For many years, it was believed that outdoor air pollution in China caused between 350,000 and 400,000 deaths per year¹³. However, a 2015 study – based on

Chinese measurements conducted at 1,500 sites and including PM 2.5 (particles smaller than 2.5 microns in diameter, and more dangerous than PM 10) – found that air pollution actually causes 1.6 million deaths per year, i.e. 17% of all deaths in the country. 83 % of Chinese people are exposed to levels of air pollution that, in the United States, are considered hazardous to health or hazardous to frail people¹⁴. In February 2021, a study published on the website *Environmental Research* estimated that PM2.5 pollution from fossil fuel combustion alone will likely cause 3.9 million premature deaths¹⁵.

In the long run, such a situation risks eroding the legitimacy of the Party, which now largely, if not solely, rests on its capacity to improve the population’s well-being. Indeed, since the events of 1989, it is as if the government had “exchanged” the absence of democratic reforms with the promise to improve the living conditions of Chinese citizens. However, the massive deterioration of the environment seriously compromises the fulfillment of such a promise. And so, during the 2000s, as pollution problems increased, causing public frustration¹⁶, the government realized that it was necessary to take a certain number of measures. One of the most significant moments in this evolution occurred in 2006 when Hu Jintao called for the construction of a “harmonious society”, i.e. a form of development that would take social inequalities and environmental damage into account. This priority was announced before the 17th CCP Congress – which was held in 2007 and confirmed Hu Jintao for a second term as the country’s leader – and was finally written into the Party’s constitution as “scientific development”. A year later, in 2008, the Environmental Protection Bureau (created in 1974) became the Ministry of Environmental Protection; it holds the 16th official rank out of the 25 ministries and commissions of the State Council. Despite this shift, the environment continues to deteriorate.

It is especially because of the increasing number of pollution peaks in major cities that the current leaders, which came to power in 2012 during the 18th Congress, launched a series of ambitious initiatives¹⁷. It is in such a context that in September 2013 the government introduced an action plan to control and prevent air pollution. In 2015, the (National) Environment Act, which dates back to 1979 and was already revised in 1989, was thoroughly revised once again. In addition, the last three five-year

7. Sources: BP, “BP Statistical Review of World Energy”, 2002 and 2020. Renewables = solar + wind.

8. The Economist, “Pocket World in Figures. 2013”, Profile Books, 2012.

9. B. Pedroletti, H. Thibault, “Pékin émerge du cauchemar de la pollution”, Le Monde, 2013.

10. H. Thibault, “Les villes de Chine contraintes de rendre leur air transparent”, Le Monde, 2013.

11. M-C. Bergère, “Chine. Le nouveau capitalisme d’État”, Fayard, 2013.

12. K. Matus et al., “Health damages from air pollution in China”, Global Environmental Change, n° 22, 2012.

13. B. Vermader, “Chine brune ou Chine verte ? Les dilemmes de l’État-parti”,

Les Presses de Sciences Po, 2007.

14. R. A. Rohde, R. A. Muller, “Air Pollution in China: Mapping of Concentrations and Sources”, 2015.

15. K. Vohra et al., “Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem”, Environmental research, 2021.

16. N. Salmon, Chapter 4 : “Analyse d’une mobilisation environnementale : inquiétudes sanitaires et enjeux politiques liés à la pollution de l’air par les microparticules”, in J-P. Maréchal (éd.), *La Chine face au mur de l’environnement ?*, CNRS Editions, 2017.

17. J-F. Huchet, *La crise environnementale en Chine*, Les Presses de Sciences Po, 2016.

plans (the 13th plan covered 2016-2020) contained increasingly stringent environmental targets.

Beyond social frustration caused by the “airpocalypse”¹⁸, the Chinese government is also gradually coming to the realization of the threats that rising temperatures pose to the country: endangerment of coastal cities (Shanghai, Hong Kong, etc.), increase in the number of extreme weather phenomena, multiplication and aggravation of droughts and floods, desertification (in a country that already has to feed nearly 20 % of the world’s population with only 7 % of the world’s arable land resources), not to mention the disruption of air traffic (during the most severe episodes), the closing of schools, and the limitation of outdoor activities¹⁹.

Climate change may, for instance, exacerbate existing water stress. Even though China holds 20 % of the world’s water reserves, its volume per capita is probably only 2,000 cubic metres per year (compared to a world average of 6,200). This can be explained by the poor distribution of water. The north of the country (north of the Yangtze), where two-thirds of farmable land and 40 % of the population are located and which generates half of the national GDP, holds only 20 % of the country’s water. Climate change is likely to reduce rainfall in this region, while at the same time, groundwater is being depleted²⁰. 440 out of China’s 660 major cities (*i.e.* 353 million inhabitants) are suffering from a severe water shortage. There is also a qualitative dimension to this quantitative problem. The water supply in half of Chinese cities does not meet WHO standards²¹. In a press conference held in Beijing in February 2012, Hu Siyi, the vice-minister of the Ministry of Water Resources, revealed that 40 % of rivers were seriously polluted, and 20 % of rivers were so toxic that humans should not even come into contact with their water. Two-thirds of Chinese cities are experiencing water supply stress, while 300 million people in rural areas have no access to clean water²². Groundwater quality has also deteriorated: 60% of groundwater in the north of the country is polluted to a level that makes it unsafe for drinking²³.

In June 2007, China published its first long-term plan on climate change. A 2011 report by the State Oceanic Ad-

ministration warned that sea levels bordering the country had risen by 2.65 millimetres per year over the past three decades, and that average atmospheric and marine temperatures had risen by 0.4 and 0.6°C respectively over the past ten years. According to the State Oceanic Administration, sea level rise is a “gradual” marine disaster that could “worsen the consequences of storms and coastal erosion”²⁴. In 2015, the head of the government’s meteorological service warned that climate change posed “serious threats” to rivers, food supply, infrastructure, etc.²⁵

Of course, the deterioration of air quality and greenhouse gas emissions are partly independent phenomena. Nevertheless, given the share of fossil fuels in China’s energy mix, it is obvious that reducing the share of coal and oil will automatically decrease the emissions of micro-particles, black carbon, etc., which are detrimental to the quality of life of millions of Chinese people²⁶.

Economic reasons

The second reason for China’s change in direction is probably to be found in the fantastic potential in terms of exports and influence that “green” or, more precisely, “low-carbon” technologies, represent. This is how, over the last twenty years, China has become the world’s leading producer of LEDs, wind turbines, solar panels, electric cars batteries, electric cars, and more.

Behind all of these “success stories” is of course the talent of Chinese researchers, company directors and their engineers, technicians, and workers – but also the “visible hand” of the Chinese government. A study conducted by the European Union Chamber of Commerce in China highlights that within the framework of the China Manufacturing 2025 strategic plan launched by Beijing in May 2015 (on which the regime no longer communicates much however), the financial support for Chinese companies announced by both the central and local governments will amount to several hundred billion euros. Among the sectors targeted by this initiative are electric vehicles, electric equipment, and robots²⁷. In comparison, the recovery plan approved by France to help the aeronautical sector, a victim of the crisis caused by the Covid-19 pandemic, amounts to some twenty billion euros. Of this, “only” 1.5 billion euros are destined to “decarbonized” aviation²⁸.

When it comes to energy production, there is massive

18. In 2005, over the recorded 87,000 “mass incidents”, 51,000 (58%) were linked to pollution issues. Even if this data is officially not published anymore since 2010, the number of incidents is estimated to 150,000 per year. See B. Pedroletti et F. Lemaître, “*Chine 70 ans de règne de l’État-parti*”, Le Monde, 2019. Some sources estimate the number to 180 000. See F. Godement, *Que veut la Chine ?*, Odile Jacob, 2012 and J-P. Maréchal, *Chine/USA. Le climat en jeu*, Choiseul, 2011.
19. J-F. Huchet, *op. cit.*
20. J-M. Chaumet, Chapter 12 : “*L’impact des problèmes environnementaux agricoles sur le commerce et les relations internationales chinoises*”, in J-P. Maréchal (éd.), *La Chine face au mur de l’environnement ?*, *op. cit.*
21. J-F. Huchet, *op. cit.*
22. Y. Jian, “*China’s River Pollution ‘a Threat to People’s Lives’*”, Shanghai Daily, 2012.
23. J-F. Huchet, *op. cit.*

24. H. Thibault, “*La Chine s’inquiète de la montée du niveau de la mer sur son littoral*”, Le Monde, 2011.
25. The Economist, “*No Cooling*”, 2017.
26. [editor’s note] See the article of S. Monjon and L. Boudinet titled “*État de l’environnement en Chine : quelles évolutions ces dernières années ?*”, page 126 for the current state of play of the environment in China.
27. European Union Chamber of Commerce in China, “*China Manufacturing 2025. Putting Industrial Policy Ahead of Market Forces*”, 2017.
28. J-P. Maréchal, “*Le décollage de l’aéronautique ‘vert’, effet ‘secondaire’ de la crise de la Covid-19 ?*”, Choiseul Magazine, 2020.

investment. In January 2017, the National Energy Administration of China announced 360 billion dollars of investments in new energy production capacities between 2017 and 2020: 144 billion for solar energy, 100 billion for wind power, 70 billion for hydroelectricity²⁹, etc. Meanwhile, the International Energy Agency estimated that the Chinese public and private sectors would invest more than 6 trillion dollars in low-carbon energy production technologies between now and 2040³⁰. As a comparison, in 2015, Chinese companies had invested more than \$100 billion in renewable energy, while American firms had spent only \$44 billion³¹.

We can see the results. Throughout its territory, China now accounts for a third of the world's wind power and a quarter of the world's photovoltaic power capacity. Chinese companies in these sectors benefit from a domestic market whose size allows them to achieve significant economies of scale and thus extremely low production costs. The same could be said for the manufacturing of lithium batteries for cars or hydroelectricity. According to the International Energy Agency, four of the top ten wind turbine manufacturers in the world and six of the top ten solar panel producers are Chinese³².

The automobile sector is not lagging behind either. The purchase of electric vehicles has been massively aided both directly (\$8.4 billion in government aid in 2015, i.e. ten times more than in the United States) and indirectly (tax incentives according to the type of vehicle)³³. In view of its success, this costly system was brought to an end in 2018. Indeed, as early as 2015, sales of electric cars (annual and cumulative) in China exceeded those made in the US³⁴. Between 2011 and 2017, the number of electric cars sold in China jumped from 4,200 to 601,700, while worldwide sales rose from 49,600 to 1,202,700.

Beyond these essentially economic reasons, the development of green technologies in China also serves some more geopolitical objectives.

Since the fall of 2019, the United States has increased its oil production to the point of becoming a net exporter. China currently imports 70% of its oil and this figure could rise to 80% by 2030³⁵. The country could thus find itself much more exposed than the US economy to the consequences of possible unrest in a Middle Eastern region where Washington now has fewer direct interests.

By strengthening the country's energy security, the

massive development of green technologies in China makes it possible to limit (at least partially) these risks. It could also counter the influence of the United States by offering low-carbon solutions to foreign countries, enabling them to reduce both their oil consumption and their CO₂ emissions.

As summarised by Amy Myers Jaffe, if Beijing's strategy is successful, it will make a valuable contribution to the global fight against climate change and help China "to replace the United States as the most important player in many regional alliances and trading relationships". In other words, China "hopes that demand for clean energy technology from countries looking to reduce their carbon emissions will create jobs for Chinese workers and strong relationships between foreign capitals and Beijing, much as oil sales linked the Soviet Union and the Middle East after World War II. That means that, in the future, when the United States tries to sell its liquefied natural gas to countries in Asia and Europe, it may find itself competing not so much with Russian gas as with Chinese solar panels and batteries." In the middle of the ongoing transformation of the energy market, China could thus obtain an edge in the rivalry between "electro-states" and "petro-states"³⁶.

However, a country's influence also depends on its capacity to entice and on its ability to conduct effective "public diplomacy", which is undoubtedly one of the reasons why Beijing played a part in the Paris agreement.

Public diplomacy factors

Beijing is using the climate issue to try and improve its international image which tends to be marred by the regime's evolution.

Indeed, between the implementation of the "social credit" system³⁷ (and the electronic surveillance of citizens that is a part of it³⁸), the detention of a million Uyghurs³⁹, the takeover of Hong Kong in violation of the commitments made at the time of its retrocession, the hawkish declarations with regard to Taiwan⁴⁰, the expansionism in the South China Sea⁴¹, the request for censorship towards Cambridge University Press or Springer⁴², the inclusion in 2017 of "Xi Jinping's vision, of a socialism with Chinese characteristics for a new era" in the Party charter⁴³ –

36. "Petrostate v electrostate", *The Economist*, 2020.

37. "Creating a digital totalitarian state", *The Economist*, 2016 ; "Keeping tabs", *The Economist*, 2019.

38. B. Pedroletti, "En Chine, le fichage high-tech des citoyens", *Le Monde*, 2018.

39. *Monde chinois nouvelle Asie, L'envers des routes de la soie : analyser la répression en région ouïghoure*, 2020.

40. "Dire strait", *The Economist*, 2019.

41. Y. Roche, "La stratégie de Pékin en mer de Chine du Sud : entre séduction et coups de force", *Diplomatie, Les grands dossiers, Géopolitique de la Chine*, 2018.

42. "At the sharp end", *The Economist*, 2019.

43. B. Pedroletti, "À Pékin, le sacre de Xi Jinping", *Le Monde*, 2017.

29. IRENA, "Renewable Energy and Jobs – Annual Review 2017", 2017.

30. A. Myer Jaffe, "Green Giant. Renewable Energy and Chinese Power" *Foreign Affairs*, 2018.

31. S. Roger, "Trump brouille les négociations climatiques", *Le Monde*, 2017.

32. "The East is Green", *The Economist*, 2018.

33. France Stratégie, "L'avenir de la voiture électrique se joue-t-il en Chine ?", *La Note d'analyse n° 70*, 2018.

34. A. Myer Jaffe, op. cit.

35. Ibid.

along with the creation of an institute dedicated to the interpretation and dissemination of this vision⁴⁴ –, or the modification of the constitution in 2018 which now allows Xi Jinping to run for as many presidential terms as he wishes, China definitely lacks some “soft power”, to quote the phrase coined by Joseph Nye thirty years ago.

In an argument reminiscent of Antonio Gramsci's thoughts on hegemony in his “Quaderni”⁴⁵, Joseph Nye writes that “if a state can make its power seem legitimate in the eyes of others, it will encounter less resistance to its wishes. If its culture and ideology are attractive, others will more willingly follow. If it can establish international norms consistent with its society, it is less likely to have to change. If it can support institutions that make other states wish to channel or limit their activities in ways the dominant state prefers, it may be spared the costly exercise of coercive or hard power.”⁴⁶ Simply put, “soft power is the power of attraction”⁴⁷.

Aware of this attractiveness deficit, Hu Jintao said in 2006: “The enhancement of China's international status and international influence must be reflected in both hard power, including the economy, science and technology, and national defence power, and in soft power, such as culture”⁴⁸. Six years later, Xi Jinping launched the idea of the “Chinese Dream”; the dream of a moderately prosperous society, of a newfound national pride, of the advent of a spiritual socialist civilisation. Political communicators are never short of a new slogan, and the “Chinese Solution” emerged in 2015, a formula used for the first time by Xi Jinping during a New Year's message on 21 December 2015 and repeated notably during the 95th anniversary of the founding of the Chinese Communist Party in July 2016. On that occasion, the President claimed that the Chinese people were “fully confident that they can provide a Chinese Solution to humanity's search for better social institutions”⁴⁹.

Given a pattern of human rights violations at home, contributing to the implementation of the Paris Agreement can only serve China's image abroad. Thus, in January 2017, just after Donald Trump's victory and Washington's predictable withdrawal from the Paris Agreement, Xi Jinping insisted at the Davos Forum that the signatory countries of the Paris Agreement should “stick” to the agreement “instead of walking away from it”.

While the term “Chinese Solution” hasn't clearly been defined, it nevertheless says a lot about the Middle Kingdom's determination to exercise leadership over world affairs and its confidence in doing so. The discourse on soft power can then serve to conceal the power relations that Beijing, like any actual or potential hegemon, is trying to establish in international relations. As Philip Golub showed, Chinese speeches on soft power, like their American counterparts, conceal and minimise the power relations present in international politics⁵⁰.

Binding commitments?

The reasons we have just outlined were translated into commitments in the Paris Agreement⁵¹. In its “National Determined Contribution” – the commitments made in December 2015 – Beijing promised to cap its CO₂ emissions around 2030 and to do its utmost to do so before then, to reduce its CO₂ emissions per GDP unit (i.e. carbon intensity) by 60-65% by 2030 compared to 2005 levels, to increase the share of non-fossil fuels in primary energy consumption to around 20% and, finally, to increase its forest stock volume by around 4.5 billion cubic metres compared to 2005 levels. These objectives, especially the first three, are potentially achievable within the announced timeframe. There are three main reasons for this.

The first is obviously the slowdown in Chinese economic growth which, in the context of a “new normal” announced in the mid-2010s⁵², is now just over 6%.

The second is to be found in the growth of the country's service sector. Over the past ten years, the Chinese economy has become a service economy (Figure 2); services increased from 40% to almost 53% of GDP, while industry lost 10 percentage points, falling from 49% to 39.9%. However, a study conducted from 1992 to 2012 shows that the average carbon intensity of services in China is 67.5 tonnes of CO₂ per million yuan of GDP, while that of industry is 838.7 tonnes, or 12.4 times higher⁵³.

As for the commitment to improve the carbon intensity of the economy from 60 to 65%, this too will be achieved for a simple reason. This indicator has been improving everywhere for several decades under the combined effect of the improved efficiency of devices that use fossil fuels and the evolution of the energy mix in favour of technologies that do not directly emit CO₂ such as nuclear, wind, photovoltaic, hydroelectricity, etc. As Jacques Percebois and Jean-Pierre Hansen have shown, the improvement of an economy's carbon intensity is closely linked

44. “Mind-boggling”, *The Economist*, 2018.

45. For Antonio Gramsci (1891-1937), a policy led by a given social group can be considered as hegemonic if the policy is consented to by the dominated classes. Initially created to analyze the workings of internal State policies, in particular Italy since the Risorgimento, the notion of hegemony has seen its greatest developments in studies of international relations.

46. J. Nye, “Soft Power”, *Foreign Policy*, 1990.

47. J. Nye, *Soft Power, the Means to Succeed in World Politics*, Public Affairs, 2004.

48. P. Golub, “Soft Power, Soft Concepts and Imperial Conceits”, *Monde chinois nouvelle Asie*, 2020.

49. “Tortoise v hare”, *The Economist*, 2017.

50. P. Golub, op. cit.

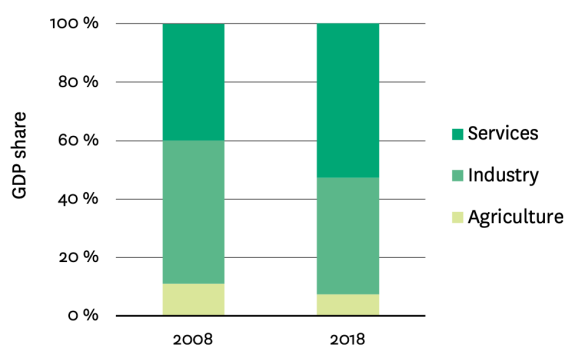
51. Numerous internal policy measures are not considered here.

52. H. Angang, “Embracing China's ‘New Normal’”, *Foreign Affairs*, 2015.

53. X. Zhao, “Decoupling Economic Growth from Carbon Dioxide Emissions in China: A Sectoral Factor Decomposition Analysis”, *Journal of Cleaner Production*, 2017.

to that of its energy intensity. However, the improvement in a country's energy intensity is a phenomenon that can be found in all industrialised countries and this occurred long before concerns about climate change emerged^{54,55}. It is true that China's carbon intensity has already decreased significantly (Figure 3), but there is still significant room for improvement. Indeed, CO₂ emissions per dollar of wealth created are still higher in China today (990 grams) than in the US in 1971 (870 grams). As for energy intensity, over the past 40 years, as seen above, China's GDP has multiplied by 26 and its energy consumption by "only" 5.

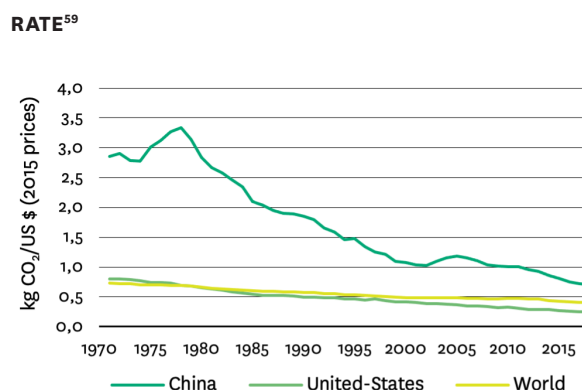
FIGURE 2 • EVOLUTION OF CHINA'S GDP BY SECTORS⁵⁶



If the 2015 commitments could be met – even if we must always be cautious when it comes to forecasting (especially when it comes to China!) – what about the new ones?⁵⁷ The presentation of the new five-year plan at the beginning of last March did not provide any particularly convincing elements.

At the December 2020 summit held (by videoconference) to mark the 5-year anniversary of the Paris Agreement, and where countries were to make announcements increasing their climate commitments, China committed itself to capping its CO₂ emissions “before” 2030 and no longer “around” 2030, to reduce its carbon intensity by “more than 65%” instead of “between 60 and 65%” and to increase its share of renewable energy to 25% of primary energy by 2030 (it is already at almost 13% as can be seen in Figure 1). This progress is not spectacular, and so these promises will be kept⁵⁸.

FIGURE 3 • CO₂ EMISSIONS /GDP AT CURRENT EXCHANGE



In addition, an announcement was made on September 22nd that carbon neutrality would be achieved by 2060. It is of course difficult to give an opinion on such a distant deadline, but certain simulations prompt caution. For example, projections by the International Energy Agency show that if Beijing were to add the measures announced in the 13th plan to the policies already implemented – what the IEA calls a “new policies” scenario – total energy consumption would rise from 3 billion tonnes of oil equivalent in 2016 to almost 3.8 billion in 2040, i.e. an annual 1% increase. In other words, despite the considerable efforts made, China will still be the world's largest consumer of coal in 2040 and the largest oil consumer in 2030⁶⁰. It is thus difficult to imagine that it will be carbon neutral 20 years later.

Beijing did not specify whether its new targets were for domestic emissions or also includes their investment in coal plants abroad, particularly along the New Silk Road. This is not a rhetorical question when you consider that in the first half of 2020, China built 60% of the world's new coal plants⁶¹. Chinese financing of coal plants abroad is expected to lead to an increase in generating capacity of 74 GW between 2000 and 2033. It is estimated that Chinese-funded coal plants outside the country already account for annual emissions of 314 million tonnes of CO₂, i.e. slightly less than Polish emissions. It is worth pointing out that many of the plants sold abroad use outdated technology and could no longer be installed in China where standards have become much stricter!⁶²

It is true that the new power plants built in China are either “supercritical” or “ultrasupercritical” and that, in 2018, they represent respectively 19 and 25% of the national network. In comparison, the United States has only one ultrasupercritical plant at the moment. The results are clear: “The deployment of these technologies has si-

54. J. Percebois, Chapter 49 “Énergie” in Xavier Greffe et al. (dir), *Encyclopédie économique*, Economica, 1990.

55. J-P. Hansen et J. Percebois, *Énergie. Économie et politiques*, De Boeck, 2015

56. Sources: The Economist, *Pocket World in Figures 2011*, Profile Books, 2010 and *Pocket World in Figures 2021*, Profile Books, 2020.

57. AFP, “Émissions de CO₂ : brouillard sur les prévisions chinoises”, 2021.

58. A. Garric, “De timides avancées sur le climat”, *Le Monde*, 2020 ; A. Garric, “2021, année cruciale dans la lutte contre le dérèglement climatique”, *Le Monde*, 2021.

59. Source: International Energy Agency, *CO₂ Emissions From Fuel Combustion*, 2017 Edition.

60. International Energy Agency, *World Energy Outlook 2017*, OECD/IEA, 2017.

61. “A greener horizon”, *The Economist*, 2020.

62. S. Nicholas, “A New Generation of Coal Power in Belt and Road Countries Would Be Toxic for the Environment and for China's Reputation”, *South China Morning Post*, 2019.

gnificantly reduced coal consumption, and therefore CO₂ emissions, per unit of electricity produced: in 2006, more than 340 grams of coal were necessary to produce one kWh, whereas in 2018, it took an average of 308 grams. In the 100 most efficient power plants, coal consumption is even down to 286 g/kWh.⁶³ Using this kind of power plant is a result of the acknowledgement that diversifying the energy mix will probably not be sufficient to reduce polluting emissions and CO₂ discharges as quickly as desired.

However, some of the information remains worrying. For instance, a report published in September 2018 highlighted that a total of 259 GW of coal powered generation capacity was under construction in China, an amount equivalent to the production capacity of all of the US's coal plants (266 GW)! This 259 GW is added to the 993 GW already in place and jeopardises Beijing's target of not exceeding 1,100 GW of coal power generation over the course of the 13th Plan⁶⁴. A year later, another report showed that between 2018 and June 2019, China had increased its coal power generation capacity by 42.9 GW while the rest of the world had reduced it by 8.1⁶⁵.

Conclusion

Finally, it is quite clear that China's evolving position highlighted at the beginning of this article is a fairly accurate reflection of Beijing's changing interests.

These are now embodied in quantified commitments based solely on intensity indicators (whereas the EU has adopted quantitative targets since the Kyoto Protocol), unquantified long-term promises, a reference year in the future, as well as an intense international communication on the issue of the climate emergency.

This does not mean, however, that China is not making many successful efforts. For instance, air quality is improving in Chinese cities. The concentration of PM2.5 in China is said to have fallen by 43.7 % between 2012 and 2018, which would have reduced the annual number of premature deaths from 3.9 to 2.4 million. It is true that, as it is the source of 28 % of global CO₂ emissions, China can influence the earth's climate, and therefore the weather conditions in its own territory.

Joe Biden's election is going to change the structure of the Chinese-American duopoly on climate. This may be for the better if collective leadership emerges. But caution is needed. As Paul Valéry wrote in 1935, we are living in an era where "any forecast becomes [...] a possibility for error".

63. T. Laconde, "Transition énergétique ; des efforts qui tardent à payer", La Jaune et la Rouge (École Polytechnique), 2019.

64. C. Shearer et al., "Can China's central Authorities Stop a Massive Surge in New Coal Plant Caused By Provincial Overpermitting?", CoalSwarm, 2018

65. C. Shearer et al., "Out of Step. China Is Driving the Continued Growth of the Global Coal Fleet", Global Energy Monitor, 2019.



Michel Aglietta • Emeritus professor at the University Paris Nanterre and scientific advisor at CEPII

The 14th Five-Year Plan in the New Phase of Chinese Reform

With its Hellenistic origins, western political philosophy claims to hold universal values that must be disseminated to the rest of the world in order to achieve an ideal state. This is why the American political scientist Francis Fukuyama believed that the end of History was approaching after the fall of the USSR¹.

This philosophical tradition is foreign to Chinese thinking. It does not recognize an ideal nature, nor the transparency of a transcendent need-to-be. It is a thought of movement; of silent, global, and continuous transformation: the Tao. The Tao's unity is the harmony of nature and society's transformation. Harmony does not mean an ideal state, but a renewal of the contradictions that constitute the movement.

According to philosopher François Jullien, only a patient dialogue between cultures can lead to recognizing the common features of human well-being. On the contrary, by describing China as a strategic rival in the face of the 21st century's global challenges – namely the Earth system's limits in the face of capitalist ambitions of unlimited growth – Western political elites are steering away from taking collective responsibility for the planet's shared resources.

Social structure and political order: from these, the rationale for reform is drawn.

In China, as in the Western world, it is recognised that the people are sovereign. But the term “democracy” means that the people (*demos*) have power over themselves (*kratos*). It is self-referential. In its etymology, democracy does not incorporate any ethical values. How is the wielding of power legitimate? The Western solution is procedural; it consists in representation through the elec-

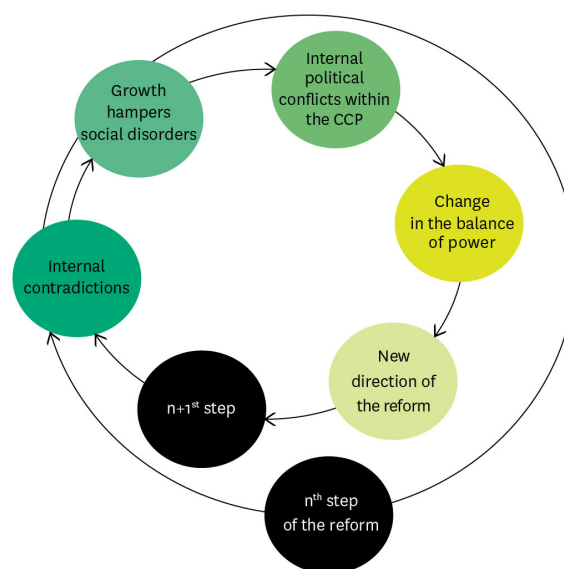
1. F. Fukuyama, *La fin de l'histoire et le dernier homme*, Flammarion, 1992.

toral process. The Chinese conception is that of finality: has government been for the greater good of the people? The unitary sovereignty of the Empire must capture the unity of society's movement. According to Mencius, a disciple of Confucius, the people confer legitimacy on political power if it is worthy of the mandate it has been given. To govern is to show the way of the Tao, by which the unitary sovereignty of the Empire grasps the unity of society's movement. If this is not the case, the people can depose the power. Legitimacy is therefore that of the realisation of societal well-being.

As we have shown in a previous book, the People's Republic under the leadership of the Chinese Communist Party (CCP) has recreated the Empire, which is to say the political order consisting of the verticality of power on the one hand, and the horizontality and autonomy of civil society on the other². What is fundamental is that the collective comes first. It is the foundation of human meaning (“ren”) which is the moral connection and an integral part of the Tao. Civil society is a system of reciprocal relationship networks (the “Guanxi”) that are built over time in the form of mutual moral debts that establish trust, and of which the family is the foundation.

The rationale of Chinese reform contributes to this political order as a transformational phase which is included in the CCP's mission to undo the century of humiliations suffered by the Chinese people (1840-1945) and thus to restore the Middle Kingdom in its abundance for the centenary of the People's Republic.

FIGURE 1 • PATH OF REFORM



In accordance with the movement's philosophy, this reform is comprehensive, pluralistic, gradual, and is nourished by its contradictions. Social tensions are produced by the erosion of harmony through the accumulation of

2. M. Aglietta, G. Bai, *La voie chinoise : capitalisme et empire*, Odile Jacob, 2012.

uncompensated contradictions. These tensions generate crucial transitions which separate distinct phases. Reform does not refer to any ideal model: the purpose is in the path. Its rationale can be represented by the diagram in Figure 1.

The two completed phases of reform before entering the new era

The first phase was that of the agricultural revolution and corporate responsibility (1978-1993). It is a twin path of commercialized farm surpluses and the introduction of corporate responsibility. This resulted in a rapid growth of agricultural revenue. But tensions arose from the lack of separation between the financial system and the public administration along with the collusion between local governments and state-owned enterprises (SOEs). An explosion of credit and non-performing loans led to runaway inflation that massively depressed real wages in the late 1980s and brought about the events at Tiananmen.

The second phase (1994-2012) began with large-scale transformation from 1994 onwards: creation of the central bank, centralisation of fiscal resources, international outreach with entry into the WTO and direct foreign investment, resolution of the debt overhang and privatisation of businesses. China also began to revolutionise the international division of labour as the “the world’s factory”. Tensions returned in 2008 with the great global financial crisis and the gigantic stimulus package to avert it: high energy intensity, environmental degradation, overcapacity and the return of over-indebtedness in heavy industries, increased inequality between cities and the countryside and between provinces, massive and widespread corruption.

The return of socio-political tensions prompted the Party’s leadership change in 2013 and the move towards a radical change in the growth model, known as the New Era.

The New Era and its long-term objectives

The New Era extends to the year 2035 when the socialist market economy will be realized. This is the first step towards a harmonious society. Three political conditions for a harmonious society were established: no organised political force should oppose the State Party; the interests of the bureaucracy should be aligned with those of the sovereign people; the welfare of the people should be developed across generations.

This resulted in the priorities of the reform’s third phase:

- **Inclusive policies:** “all under heaven” according to the Confucian principle of “ren” (the human dimension). In order to respect institutions, all ci-

tizens must have a common interest in them.

- **Balance with nature:** the ecological footprint must respect the Earth system’s limits; this implies the restoring of natural resources and reestablishing the regulation capacity of ecosystems. Therefore, ecological policy must be the guiding principle for technological innovations in order to achieve the Sustainable Development Goals set out by the United Nations.
- **Global balance:** develop the pharaonic “New Silk Road” project (Belt and Road Initiative, BRI) to encourage countries to cooperate for mutual benefits, leading to international regimes of mutually-agreed rules. This alone will make it possible to build planetary common goods within the Earth system’s limits.

The quantitative focus of GDP is no longer relevant for qualitative growth. The United Nations’ Inclusive Wealth Index (IWI) is the composite indicator, which combines productive capital, human capital and natural capital weighed by countable indices which approximate the marginal social productivities of these three types of capital. An equivalence theorem shows that maximising inclusive wealth is equivalent to maximising the social welfare of a community³. However, UNEP’s measurement of IWI has shown that, in the great growth phase from 1990 to 2008, China was the country where IWI progressed the most among advanced and large emerging countries in terms of IWI per capita (average annual growth per capita of 2.1% over 1990-2008), mainly due to the massive reduction of poverty, whereas the average annual growth of GDP per capita was 9.6%. The two indicators are therefore not of the same nature. Moreover, one is a stock, a wealth, and the other a flow.

It can be concluded that the economic growth of a nation is sustainable over a long period when the variation of its IWI per capita is positive or null. However, many developing countries, especially in Africa, have negative IWIs⁴.

China’s performance in terms of IWI per capita has been far from that of GDP per capita for several reasons: the development of material capital has largely been at the cost of the destruction of natural capital; overproduction in heavy industry has led to a drop in the marginal productivity of productive fixed capital; urbanisation has been very costly in terms of environmental destruction; the urban-rural divide has worsened because of insufficient social transfers and the persistence of the hukou system, which hinders migration to the cities.

The new phase of reform therefore involves a redeployment of the productive base for social benefit. Invest-

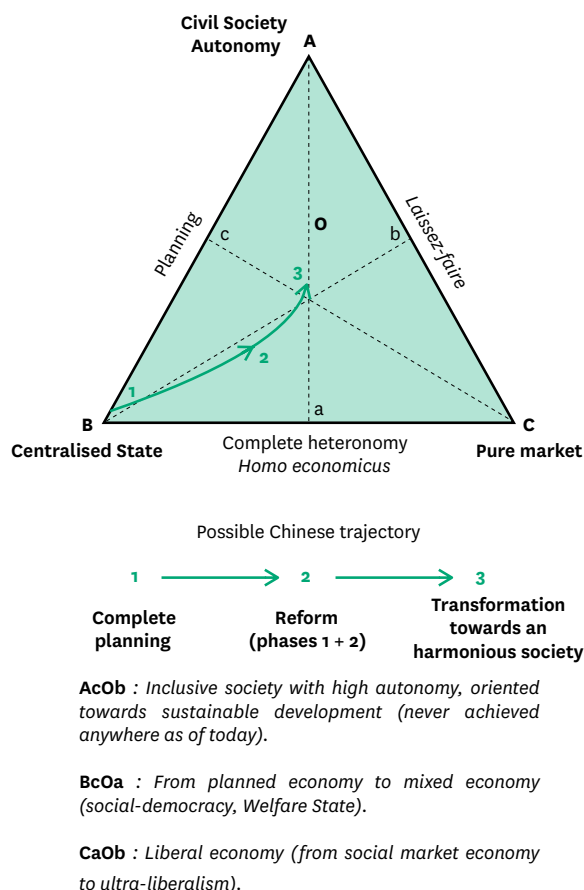
3. The Dasgupta Review, *The economics of biodiversity*, 2021.

4. S.Managi, P.Kumar, *Inclusive Wealth Report 2018*, UN environment, 2018.

ment in human capital is needed to move the production structure towards the technological forefront. Investment in natural capital is needed to adapt urbanisation to climate change and to achieve the energy transition. The 14th Five-Year Plan must be a resolute step in this direction.

The secular transition of Chinese society – from the establishment of the People’s Republic to the fulfillment of the harmonious society – can be represented by an equilateral triangle consisting of the centralized state and the unrestricted market, civil society as an autonomous entity and the heteronomy of *homo economicus* (Thatcher: “there is no such thing as society, there are only individuals and markets”), and planning and laissez-faire. China’s trajectory is towards the centre of the triangle which represents a harmonious society (see Figure 2).

FIGURE 2 • ORGANIZATIONAL MODEL OF SOCIETIES FOR CONSIDERING ECONOMIC TRANSFORMATION AND SOCIAL CHANGE IN A SINGLE APPROACH



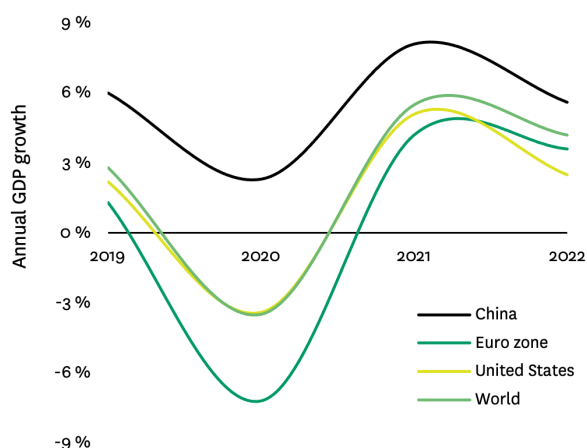
The 14th Five-Year Plan in the long-term trajectory: the legacy of the 13th Plan

In 2013, the Party changed its leadership with the arrival of Xi Jinping as Secretary General. The Central Committee launched the preparation of the 13th Plan in November 2013 with six objectives: transform the growth

model from capital-intensive accumulation to innovation in order to raise overall productivity, integrate urban and rural areas and reducing inequality between provinces, develop ecology for a low-carbon economy, promote inclusive growth to reduce social inequality and completely eradicate poverty, reform finance to control debt, and pursue international outreach by attracting foreign investment.

This transformation from quantitative to qualitative growth should therefore be accompanied by fundamental social reforms. Important steps have been taken with the “Go West” movement and progress in financial reform. But two challenges have emerged. One is the pandemic, which has caused total debt (public and private) to jump to 288% of GDP. The other is the widening of the North-South divide with the relative decline of the industries that had been the backbone of the previous growth model. The bold response to the Covid-19 crisis allowed for a rapid but unbalanced economic recovery, which reignited a wave of real estate speculation in the major cities.

FIGURE 3 • GLOBAL GDP GROWTH AND GROWTH OF THE TOP THREE POWERS 2019-2022 (%)⁵



This is why the government, in stark contrast to the new US policy, is taking a very cautious approach to macroeconomic growth in 2021, announcing growth equal to or greater than 6% while international organisations are predicting 8%. The government’s caution is linked to the uncertainties of the global economy which could require a smoothing of the recovery with reserve budget resources. This is why the government has decided to reduce the central government deficit from 3.6% to 3.0% of GDP.

The guiding principle of the 14th Five-Year Plan: dual circulation

The structural change targeted by the growth model has two main objectives. The first concerns the domestic

5. IMF, *World Economic Outlook Update*, January 2021.

economy, which is seeking to develop a gigantic consumer market for a growing middle class. The second concerns international relations, which China hopes to transform with the New Silk Road project, designed to promote a new globalisation capable of encouraging cooperation between emerging and developing countries for a truly multilateral world order where China would regain its place as the Middle Kingdom. Dual circulation is the key to this new growth model.

Internal circulation for the development of household consumption is directed towards the long-term goal of realising the socialist market economy in 2035 within an eco-civilisation. This internal circulation seeks a system of innovations based on the interdependence of political ecology and the digital economy to control climate change. Four types of policies need to be supported and coordinated:

- Efforts in research and development (R&D), which will be crucial in the field of technological innovation.
- Continued and intensified territorial renewal policies to create integrated regional areas. In order to limit debt, this will require transfers from the central budget to the poorest and least-developed regions, particularly for the construction of low-carbon transport infrastructure and for the renovation of buildings to be energy efficient.
- The deployment of social policies to reduce inequalities and the abolition of the hukou to facilitate migration from the countryside to the cities. These migrations are encouraged towards dense cities of the second and third categories and must be accompanied by training in order to help migrants adapt.
- Prioritizing education is therefore the counterbalance of the reconversion required by this transition of production structures.

External circulation is structured in three hierarchical levels:

- Asia's economic integration through the world's largest free trade agreement, the Regional Comprehensive Economic Partnership (RCEP).
- The land and sea infrastructure network linking Asia, Africa, and Europe along and around the ancient silk routes.
- The intercontinental network linking the two oceans, Atlantic and Pacific, through the polar route on the one hand, and land and sea routes through Central and Latin America on the other hand.

This monumental project necessitates multilateral cooperation in order to overcome the enormous amount of debt that its financing requires. But current geopolitical rivalries do not lend themselves to this. China's intentions

arouse suspicion, because it is seeking a strategic repositioning in an Asian continent that will become dominant in the multilateral reshaping of the planet

The main axes of the 14th Plan: unified consumer market, new urbanisation, energy transition, and ecosystem rehabilitation.

The transformation of the domestic market through a digital economy by controlling the danger of over-indebtedness.

Covid-19 has accelerated five trends characteristic of the New Era: digitisation, reduced external openness, increased non-price competition, new spending behaviours among young adults, and the greater influence of the private sector.

China's digital economy is by far the most advanced in the world with 850 million e-commerce participants, representing 24% of retail trade compared to 11% in the US⁶. This was highlighted by McKinsey's survey of Chinese consumers earlier this year: 40% of respondents plan to increase their income by investing in wealth management or insurance products.

Savings behaviour has become more sophisticated among young adults in the middle and upper classes. Consumption has become more controlled instead of impulse spending, and purchasing decisions have become health conscious; this has raised the concern for product quality.

The main weakness remains that of vulnerable debt in real estate and personal loans on credit cards. This weakness has been exacerbated by the fall in revenues in the first half of 2020. China Merchants Bank's third quarterly report highlights 81.3% rise in non-performing credit card loans⁷. The government has responded by refining legal rules and developing financial techniques adapted for restructuring non-performing debt.

A new type of urbanisation to drive consumption.

The 14th Plan reinforces the "Go West" policy to reduce territorial and social inequalities by facilitating migration from the countryside to the cities. While 60.5% of the population were urban in 2019, 65% are projected to be so in 2025, and more than 70% in 2030, i.e. a flow of 10 million migrants per year⁸. This will increase productivity, provided that public investment in retraining is forthcoming. This is where planning is essential, by giving priority to long-term planning for the continuity of public policies.

6. "Understanding Chinese Consumers: Growth Engine of the World", McKinsey & Company, 2020.

7. M. Aglietta, G. Bai, C. Macaire, "The 14th Five-year Plan in the New Era of China's Reform", Policy Brief CEPII, 2021.

8. Li Keqiang, Report on the work of the government, 2021.

Consequently, the pressure on property prices in large cities requires strict price control and an increase in the personal contribution for housing purchases in Beijing, Shenzhen, and Shanghai, while encouraging migrants to settle in second- and third-tier cities through the abolition of hukou.

By shifting economic activities to compact cities connected by ultra-modern railway networks financed by budgetary transfers, the new urbanisation can be attractive. In turn, the leading urban areas benefit from building renovation programmes and the creation of high-tech zones.

The energy transition and the rehabilitation of ecosystems

The commitment to carbon neutrality by 2060 gives a new long-term direction to economic development. It is about linking the energy transition to sustainable development for the intergenerational progression of inclusive wealth. The 14th Plan proposes conservative targets consisting of extending the achievements of the 13th Plan, i.e. a 13% reduction in energy intensity and 18% in carbon intensity, while maintaining the objective of reaching a peak in greenhouse gas emissions in 2030.

Concrete policies are being implemented to move away from coal in electricity production through renewables, the costs of which are decreasing, but also through other sources (hydro, nuclear, natural gas) and finally through carbon sequestration techniques. New coal plants will be banned with budgetary support for the conversion of coal mining communities.

Energy security can be achieved through artificial intelligence by using smart grids that compensate for the local unpredictability of renewable energy sources. Indeed, according to Nicolas Stern and Xie Chunping⁹, managing electricity demand through smart grids could allow solar and wind power to significantly reduce their costs and provide 62% of China's electricity production by 2030. Finally, during this current decade, technological innovation could lead to the use of hydrogen in electric vehicle batteries and the installation of recharging stations to achieve all-electric urban transport.

Recognizing the planetary limits of the Earth system

These limits acknowledge the interdependencies of ecology and economy in biogeochemical cycles¹⁰. They are linked to the importance of natural capital in the

inclusive wealth on which intergenerational social well-being depends. Biodiversity has a regenerative capacity that contributes to the healthy functioning of ecosystems: it is thus of crucial importance in increasing the productivity of natural capital in inclusive wealth.

China has made progress, albeit recently, in restoring ecosystems after having largely contributed to their destruction under the capital-intensive growth model. Soil erosion has been reduced by transforming 30 million hectares of desert into forests and wet grasslands in 25 provinces, according to the *Dasgupta Review*¹¹, thereby sequestering carbon and limiting run-off and flooding. In addition, protected development areas have been created based on natural capital assessments.

The 14th Plan and the international dimension of dual circulation

Let us remember that the BRI is a project for reshaping globalisation on three levels: Asian integration, resurrection of the Silk Road in various paths, and a transcontinental, digital, and infrastructural system to cover the planet.

The BRI has multiple functions to support China's inclusive growth model: supply of raw materials (including rare metals) and primary energy sources, research into semiconductors for advanced technologies, development of all-electric transportation, securing markets for export products, and differentiation of partners.

In this strategy, there is the potential for fruitful Chinese-European cooperation (Comprehensive Agreement for Investment, CAI) since it goes beyond a trade agreement by addressing investment. China's commitment, which is of interest to Europe, is to eliminate investment restrictions in Chinese industry and services, to make subsidies transparent, and to prohibit forced technology transfers. However, the agreement remains limited in scope in its first phase as reciprocity is not included in the document. Nevertheless, the potential for future European investment in China is great.

Technology standards for 2035

E-commerce is a competitive monopoly between digital platforms. In this innovation-driven competition, standardisation is crucial for interoperability.

In China, the State is at the heart of standardisation in a public-private partnership under the authority of the SAC (State Administration of China). The SAC wants to reform standardisation in anticipation of the 2035 goal to make China's participation in international competition more fluid. Instead of a multitude of national and local

9. N. Stern, C. Xie, "China's 14th Five-Year Plan in the context of Covid-19: Rescue, recovery and sustainable growth for China and the world", Grantham Research Institute on Climate Change and the Environment, 2020.

10. J. Rockström et al., "Planetary boundaries: exploring the safe operating space for humanity", Institute for Sustainable Solutions, 2010.

11. Dasgupta Review, *The Economics of biodiversity*, London HM Treasury, 2021.

standards, there would be only two types: one would be national under state control for safety and health; the other would be determined by business associations under administrative supervision. The BIR would become an avenue to internationalise Chinese standards by signing cooperation agreements with participating countries.

Conclusion

According to the World Bank, China has entered the club of advanced countries, which gives greater credibi-

lity to the shifting of reforms towards a socialist market economy by 2035. This implies more opportunities in domestic, social, and ecological reforms on the one hand, and more geopolitical responsibilities on the other hand.

The 14th Plan is the first step in this new “Long March” to develop the world’s largest consumer market and to influence its standards. At the international level, the New Silk Road initiative marks the beginning of a new multilateral geopolitical order.



Pierre Charbonnier • Philosopher, teacher at Sciences Po in Paris and research fellow at the French National Center for Scientific Research (CNRS)

For an Ecological Realpolitik

34

On September 22, 2020, Xi Jinping, the chairman of the People's Republic of China, announced a plan to reduce greenhouse gas emissions with the aim of achieving carbon neutrality before 2060. Here, then, is China, the world's largest CO₂ producer and leading industrial power, sometimes dubbed the “chimney of the world”, seemingly embarking on an unprecedented path of development.

In a text published a few days later, historian Adam Tooze unpacked the geopolitical implications of the announcement, which he sees as a major turning point in the international order. Given China's strategic, environmental, and economic weight, Xi's announcement—regardless of its subsequent implementation—could act like Archimedes's lever and cause a profound realignment of commercial and industrial policies currently in place. But this announcement also means that an authoritarian ecology is on the march, which makes it urgent to reposition Europe's environmentalist strategies to give democratic alternatives a chance.

In Europe, and especially in France, this news was greeted with extreme caution, when it was not met with silence. I would like to try to explain the reasons behind Europe's inability to grasp the implications of the Chinese commitment, and what this inability says about the prevailing conception of the environment in our European provinces.

The first point that is absolutely crucial to stress, and which Tooze only implicitly indicates, is the monumental historical paradox that consists in making a show of political power by launching a program of fossil disarmament.

Ever since the emergence of industrial societies, particularly after World War II, the capacity to mobilize resources, especially energy resources, has coincided al-

most perfectly with influence on the global political scene. Coal and oil are not only the primary engines of a production capacity that generates high levels of consumption and a relative pacification of class conflict; they are also the stakes in cross-border projections of power designed to secure low-cost, steady supplies. The political order that emerged from World War II was obsessed, after the episode of fascism, with a search for stability (in the absence of genuine peace). It found an instrument of unparalleled power in the development of productive forces, serving both to ease internal tensions in industrial societies and to maintain the status quo between these nations and the new players that emerged from decolonization.

These historical dynamics explain the reluctance to pursue the path of an ecological revolution. Although earth system science has provided us with detailed evidence of the climate imperative, the inertia of the development paradigm and its percolating effect on both international relations and class relations have paralyzed the green turn. Without this engine of growth, how, one wonders, can “the social model” of industrial societies be preserved, and how, one wonders on the other side of the world, can the demands of development be satisfied?

The announcement by the chairman of China disrupts this logic—hence its historical importance. With the United States mired in a democratic crisis and Europe stuck in its wait-and-see attitude, China has taken the lead and opened a breach by signaling that it is now possible, indeed necessary, to pursue power politics without relying on fossil fuels. It goes without saying that China's plan for financing a decarbonized production infrastructure in no way means that the country is abandoning its dream of geostrategic influence and development, but simply that from now on it intends to ground its power—both its economic engine and its strategic base—in other material possibilities.

In doing this, China is killing two birds with one stone. It is responding to science by preparing for a future in which global warming is limited, and it is consolidating its internal and external legitimacy by appearing as a responsible actor aligned with the objectives announced in the Paris Agreement. Tooze, as an historian of the economics of war, makes perfectly clear the simultaneously realistic and moral character of Xi's announcement. We cannot continue to content ourselves with a debate that pits self-serving intentions geared toward power gains against purer intentions aimed at the global common good. Both dimensions are present in the Chinese announcement, and we must be prepared for them to be constantly mixed together in the years to come.

But this also takes on significance in terms of political philosophy, and this is no doubt what we missed in Europe. If it is true, as I have suggested in *Abundance et*

liberté (Abundance and freedom), that human interests in the political sphere always depend on material possibilities (more or less perceived as such), then we must admit that we are living through a fundamental shift in these geo-ecological assemblages. While we have long been asking ourselves the question of the perpetuation of a legitimate political power—that is, of a democratization of capitalism—in the context of an ecological and energy shift, we must now accept the idea that such shifts will instead feed processes of relegitimation and power consolidation. This utterly crucial reversal in the materiality of modern politics is being played out before our very eyes. The shaping of post-carbon politics is not a peaceful landing in the world of shared interests, but rather a theater of rivalries organized around new infrastructures, new assemblages between political power and the mobilization of the earth.

The second point to stress is more directly related to the movement for the climate and the environment (the red-green universe) as it exists in the West. In recent years there has been a rapprochement in Europe and in the United States between the political imaginary of the traditional social-issues left, heir to the workers' movement, and that of political ecology. Admittedly, the compromise between these two worlds remains quite fragile, to the extent that the alignment between the exploitation of humans and of nature is debatable. But a strategic pact is nonetheless taking shape around reactivating economic interventionism, in a play on references to the postwar period. The Green New Deal, in its significantly varied American and European versions, does not yet structure investment plans that are both capable of meeting the challenge and truly rooted in social justice objectives, but it has imposed itself as the common ground of the Western left.

Yet the strength of the Green New Deal is also its weakness. This plan for economic and social reconstruction aims to break through the barrier of the employment problem by subordinating energy transition to wealth redistribution, control of investment channels, and even job guarantees. Thus defined, this project runs the risk of preserving the structural inequities between Global North and Global South. Whereas the so-called “developing” countries will lack the means to finance such plans, their partners to the North will have the wherewithal to reinvest their techno-scientific capital in a renovation that will only enhance their “lead” and their security. This paradox, which Tooze recently analyzed, is all the more embarrassing for the social-ecological left inasmuch as it compromises its rallying cry, namely the discourse of inclusion and global justice. Seen from the Global South, the Green New Deal often looks like a consolidation of the advantages gained during the colonial period of extractivism, and also like a lifeboat for advanced economies at a time of global disturbances.

Since at least the 1990s, Western environmentalism has been the subject of scathing criticism, notably from India. Ramachandra Guha, for instance, exposed the colonial and racist imaginary of the “wilderness” that enabled Americans to cleanse their urban and industrial guilty conscience by way of natural parks, which were established by evicting indigenous populations. This colonial disorder, which accompanies the environmental policies of the wealthy, continues to a certain extent with the paradox of the Green New Deal. There has long been a gap between ecology's universalist, moral discourse, including when it is linked to social issues, and the darker reality of the structural, material inequities that it struggles to offset. We know therefore that ecology's moral superiority does not amount to much, that it is something to be forged rather than posited. Peaceful ideas are often intimately bound up with a violent world.

And in this respect, too, the Chinese decision has upended the game. Indeed, the plan Xi announced to phase out fossil fuel dependence is based neither on a moral argument with regard to the environmental ravages caused by extractive industrialism, nor on the desire to curb or abolish the system of capitalist exploitation. It simply seeks to modify its material foundation, in what could be called an eco-modernist perspective, which is not incompatible with power ambitions. It so happens that, because of the Chinese economy's weight on a global scale, this plan—decided in a vertical, top-down fashion—is likely to have beneficial consequences for the global climate, and hence for all of humanity (which is what distinguishes it from a similar plan adopted in France, for example). At the same time, the plan is but a lateral consequence of global power-game decisions made in Beijing—a game the chairman of China knows how to play well.

We Europeans tend to think (and I am no exception) that the ecological question has taken over from a liberating movement that has run out of steam. We think, in other words, that environmentalism enshrines the social demands of equality and freedom in a new regime of production and consumption that could loosen the hold of economic exploitation and individualist anomie. In short, the point is to promote the emergence of a new social type, breaking with the one that accompanied the period of rapid growth, and rely on this to reactivate the process of democratization and social inclusion that has come to a standstill. This project can be used to disqualify the Chinese announcement, to assert that it does not rise to the challenge or that it resolves the problem through authoritarian means. That may well be. But by adopting this strategy (and I believe that this is the prevailing attitude in these spheres), we run the risk of not fully grasping the geopolitical and ideological waters in which we are navigating willy-nilly, and hence of not grasping the historical sense of our own project.

Indeed, it is simplistic to imagine that the conflict in which we are caught pits exploiting, alienating, and extractive capitalism against a political ecology of reconciliation between human beings, and between humans and nonhumans. This would be the consequence of conflating the countercultural lexicon of environmentalism with the lexicon of social critique in the red-green universe: ecology or barbarism. But now we find ourselves in a situation where aging fossil capitalism, mired in its material and social contradictions, coexists with a state capitalism engaged in accelerated decarbonization, and with the more demanding and radical path of reinventing the meaning of progress and the social value of production. If we accept this description of the situation, as clearly rudimentary as it is, Europe's red-green left takes on a different significance. It is then no longer locked in a binary confrontation with capitalism (reputed to be unfailingly fossil) in which it embodies the frontline of progress, invested as it is with a universal mission. The Chinese model that is being developed provides a third term, a third model of development, which is both compatible with the global climate aims defined in the 2016 Paris Agreement and possibly in tension with the green ideal of democracy that the social-ecological movement advocates.

Otherwise put, political ecology loses its status as the unique countermodel; it loses its ability to impose itself in debates as an anti-hegemonic political form. Two questions follow from this. First, what kind of alliance will it establish with the Chinese model to safeguard at least what is essential on a strictly climatic level, at the risk of no longer having "clean hands"? And, symmetrically, how will it make its specificity heard with regard to this new paradigm?

The European social-ecological left must figure out whether the Chinese announcement has "stolen the spotlight," so to speak, by embodying the central path towards breaking the climate impasse, or whether, by a more complex game of three players, which also involves relations with the United States, it opens a breach that must be entered without delay. This breach is quite simply the definitive weakening of fossil capitalism, that is, of the American way of life (indeed, the US appears to be the weakest player on the global political and economic scene right now), consequently opening the possibility of a more direct debate between China and Europe.

To put the question even more simply: What political forms should undergird the ecological turn? European ecology must take a turn towards realism. This does not mean it has to embark on an aggressive, pugnacious debate with other geopolitical players, but it must abandon its harmful habit of expressing itself in consensual, pacifying, and even moralizing terms, and agree to play on a complex political terrain.

After all, this dimension has always been present in the history of social welfare, even though we don't always like to be reminded of these things. The development of systems of protection began in Prussia; and, in a way, Xi Jinping is a little like the Bismarck of ecology: he does not so much listen to the demands of environmental justice as he anticipates them in order to silence them. The postwar advances in social rights in Europe are incomprehensible outside the geopolitical game that combines the specter of fascism, the war to be stamped out, the Bolshevik possibility, and American influence. As a British political representative put it, "The National Health Service is a by-product of the blitz."¹ The fact is that emancipation is not always, and not even primarily, won through expressions of moral generosity; it is also a matter of power. The figure of Lenin seems to be making a return to favor in critical thought, perhaps precisely because ecology has not yet found its Lenin.

The ecology movement should therefore agree to talk about strategy, conflict, and security; it should present itself as a dynamics of building a political form that assumes the idea of power without scaling back on social and democratic demands. In fact, these demands can only be achieved if they are invested into specifically political reflections and practices. But for this to be possible, we have to leave behind our tendency toward moral depoliticization, because we no longer have a monopoly on the critique of the fossil development paradigm. A new arena is emerging, and we have no choice but to launch ourselves into it².

1. J-W. Müller, *Contesting Democracy*, Yale University Press, 2011.

2. CREDIT: GREEN is publishing an article originally published in e-flux journal, no. 114 (December 2020). Translated from the French by Gila Walker. © e-flux and the author.



Adam Tooze • Kathryn and Shelby Cullom Davis
Professor of History, Director of the European
Institute at Columbia University

Enrico Letta • Former Prime Minister of Italy,
dean of Sciences Po's Paris School of International
Affairs, President of Jacques Delors Institute

Laurence Tubiana • Director of the European
Climate Foundation. French Climate Change
Ambassador and Special Representative for the
2015 COP 21

Jason Bordoff • Founding Director of the Center
on Global Energy Policy at Columbia University
SIPA. Previously, Special Assistant to the President
and Senior Director for Energy and Climate
Change on the Staff of the National Security Coun-
cil (2009-2013, Obama's administration)

Alex Halliday • Director of the Earth Institute,
Columbia University. Previously, Dean of science
and engineering at Oxford University.

Can the EU Lead the Fight Against Climate Change?

Adam Tooze — In light of the important compromises reached last December on Europe's new goal to reduce carbon gas emissions by 55% by 2030, I would first like to ask Enrico and Laurence how they view the development of Europe's climate policy since the inauguration of the Green Deal.

Enrico Letta — Last spring was a crucial moment. We were at a crossroads and had to define priorities. We chose to save the economy and jobs which could have left climate change and the environment in the background. The choice made by the European Commission and European Council between May and July, and the decision taken by the European Council on the 21st of July, was I think the right one. They decided to combine the two priorities in the Green New Deal which was seen as the best reaction to the recession. I think that was the crossroad.

The agreement last week [*ndlr. in December 2020*] was important, but somewhat to be expected. The main difficulty was reaching an agreement with Hungary and Poland, both heavily dependent on coal-based energy. The big decision was of course to set 55% as the key emission objective. The main point is now to start implementing the agreement because it's enormous. An essential step towards that was inventing the Corona bonds and the taxation on July 21st. These tools will be the heart of the

Green New Deal. This is something completely new, it is new money which will be spent on green development. So, I am optimistic. I think that 2020 was a very risky year for the Green New Deal and that we overcame multiple obstacles.

Adam Tooze — Laurence, as one of the parents inspiring the 2015 Paris agreement, how do you see Europe's position five years from now?

Laurence Tubiana — Building on what Enrico said, we have to remind ourselves of what kind of a community Europe is. The European election two years ago demonstrated that young voters want Europe to be greener and want to believe in the European project. The Green Deal is therefore a crucial political issue. It's not just a series of directives that will be developed over the next six months. Building upon the Green Deal is a necessity if we are to maintain a semblance of European unity. That has shown in our response to the crisis, through the issuing of green bonds which alter the way the budget will be developed. The second important element is that at least 30% of the recovery or transition Fund, which is a massive financial fund of 1,700 billion euros, must be spent on climate action. For the first time we are seeing climate being recognized across the different sectors. It is being taken into account in industrial policy, state aid, competition policy, agriculture (albeit still minimally) transport, housing and we are beginning to acknowledge the extent of the effort necessary to close European coal power plants and mines.

The 55% mark was a minimum if Europe was to properly take a stance against climate change. We know that the Parliament in particular, including the Conservative Party, has asked for more than that. Something between 60 and 70% of European citizens want Europe to take more intense climate action. Fulfilling the Paris Agreement was also necessary for international soft power. There is a constituency for climate action, both at a business level, at local authority levels, at the citizens' level, which is entirely different from five years ago. As Enrico said, the Council was important, but mostly because it came because of a huge movement in European societies. We'll certainly see climate action taking new directions as it's at the core of contemporary political issues.

Adam Tooze — In some sense, is it Europe's answer to the specter of populism? As director of the EI a couple of years back, it was difficult to run a panel without people wanting to debate the issue of populism. Italy was one of the polities in Europe that was seen by centrists and people committed to the EU project, as in danger of being overwhelmed by the forces of populism. Would it be reasonable to say as a paraphrase, Laurence, that you see it not simply as a repressive or dismissive response, but in fact, as

a positive and creative response?

Laurence Tubiana — I do think so. The mobilization of the people going to vote for the European election revealed they were not only against the far-right but for something. In the face of the polarization of European societies, be it due to identity politics or the threat from the far right, we want the ecological transition in Europe to be a factor of unity. We have developed very interesting studies on the fragmentation of European societies across the main countries in Europe, including Italy, Poland, etc. The issues that unite people the most have little to do with political institutions and are quite liberal. The ecological transition may be our unifying factor. There is an anti-climate group, but it's relatively small. I think that as politicians begin to understand this Commission, they'll want to address European citizens directly through consultations, because they feel this is a question for which one can find a large constituency.

38

Enrico Letta — I agree with Laurence. Looking back at the political environment during the 2019 European elections, we were at the heart of the Trump- Brexit period. Some narrative was saying that after Brexit, after Trump, it was time for Europe to change. The expectation was for the populists to achieve a strong success in the election. In reality, the electoral result was characterized by two main points. The first one was the unexpectedly high turnout. We reached 50.5% as opposed to only 41% in 2014. That was the first time since the first election in 1979 that we had an increase in the turnout, and that, by close to 10%. The second point was the poor score of the populists. They achieved very good results in Italy and in France, but Europe is made up of 27 countries. At the European level, they are very marginal. The fact that the Commission has a big support from these young participations rallying behind the green flag is essential. Now we must work at applying what we have decided, and Europe must lead the way in tackling global climate change. For that we need the European Union to be united and working as it did in 2015 in Paris.

Adam Tooze — Fascinating, I was tempted to make a play on words in saying it's not so much Europe leading on climate as climate leading Europe, or at least enabling a particular group of politicians to lead Europe in the direction they want to go. Alex, Jason, and I are all stuck over on this side of the Atlantic where the political events all around us cannot but preoccupy us. I'm not going to resist the temptation to ask Jason how he reads our election here in terms of the climate issue. Was it a way for the Democrats to lead America back to center ground? Or is that perhaps too optimistic a reading of this last election?

Jason Bordoff — Well, I think here in the US we have a divided electorate on this issue. But I think it is notable how central a role climate change played in this election. If you look at President-elect Biden's agenda on his transition website, you'll see a button in the upper right-hand corner called priorities. He only names four priorities, of which one is climate change. I think that's significant of how climate change will be elevated as a priority. Furthermore, if you read through what's on the website about climate change, you'll notice climate change is centrally related to the other priorities on that drop-down menu, which are recovery, economic recovery, dealing with the pandemic and racial justice. This demonstrates that the democrats are going to be thinking about how climate action can be taken in ways that also contribute to our economic recovery. At a time when government interest rates are particularly low and borrowing rates are negative in real terms, now's the time to make investments that not only get the economy back on its feet, but pay dividends in the long run, particularly regarding challenges such as climate change. A last point I thought was notable, and I'm sure intentional, was that President-elect Biden's climate envoy was announced not as part of his environmental team but as part of his national security team. Having someone of Secretary Kerry's stature and experience elevating the role of climate change in US foreign policy through climate diplomacies—entering Paris and having an ambitious approach to next year's Glasgow conference, I think is extremely notable.

Although much depends on whether the Senate stays in Republican hands, there are many reasons to be optimistic. There are also areas where a bipartisan agreement can be reached, and I hope some stimulus dollars, which are going to be needed in the transition towards clean energy, will be deployed. There is support across the aisle on energy, R&D, and innovation. There are also many tools available to the administration with its existing regulatory authority, particularly the Environmental Protection Agency regulations on emissions from power plants, cars and trucks that can be used to help set an ambitious target for 2030. Finally, all the tools related to foreign policy, where the executive branch is dominant are not to be overlooked. I was part of a group of experts who worked under President Obama to put together something called Climate 21. It was an effort to lay out agency by agency - how to think about organizing federal departments to prioritize climate, including in foreign policy. I think that's an area where we're going to see a stronger effort. This may seem obvious for the EPA or for the Department of Energy, but even the agencies that may not in the past have thought of climate as central to their role, are going to think harder and more creatively about how to make the climate a key part of their objectives. Whether we're thinking about housing and urban development, the Treasury Department and debt relief, multilateral finance or even tax policy, I feel that the climate issue will penetrate

all the spheres of the federal government.

Adam Tooze — Yes, I highly recommend the Climate 21 website if you're interested in how the machinery of American government works, because it's literally a blueprint as to how to parachute teams of people into complex American governmental departments and have them have an impact. It's an extraordinary document if you're at all curious about how not the West Wing of fantasy but the West Wing of actual practice works. Alex, you took a risk by moving from the UK to the United States into this maelstrom here, from a country which has emerged as a pioneer of the de-carbonization of electric power generation, to a country where the politics are so fraught. How do you read that triangle at this moment, from the vantage point of somebody who has an interest in trying to engineer an intellectual synthesis around these problems at this moment?

Alex Halliday — I think it's fair to say that the UK has been a very strong leader in the past in terms of understanding climate change and acting on it. Before anybody else, they had legal framework to bind parliament to action on climate. The question is whether they will maintain that momentum of leadership. Boris Johnson's talks a good deal about how he wants to pursue a green agenda for the UK, and there's bipartisan support for that. However, the UK is facing some serious economic issues, dealing with a pandemic, and facing Brexit. How that will play out for them isn't particularly clear. However, do think the Glasgow card is an opportunity for the UK to help maintain its momentum in terms of providing some level of global leadership in this area.

The most exciting thing of all is this opportunity for America to reenter the Global Agenda, as a leader in climate change, policy, and strategy. Without knowing what Biden is thinking, given the geopolitical landscape, forming, rebuilding ties with Europe right now might seem a very sensible thing to do, given that lot of traditional ties with NATO and other multilateral organizations have been somewhat damaged or frayed over the last few years. In addition to the necessary rebuilding of diplomacy, it strikes me that working with Europe would achieve phenomenal advantages in terms of being able to provide leadership for the rest of the world.

However, when it comes down to what the Green Deal implies, what real solutions to climate change are to be found, we may think about renewables, about electric vehicles, carbon taxes at the borders, or trying to bring in negative emissions planting trees. But, if you do the sums, what's really needed to achieve that 1.5°C is massive. The impact must be achieved extremely fast, changing the in-

dustry, changing the energy sector, etc. We will have to deal with disenfranchised communities who are suddenly going to be left behind, in the coal industry for example. That is enough to totally upset a democratic organization. It's easy to say we're going to put a trillion dollars into this. But maybe that's money you've been using for farming in the past, and that you're now using for the energy transition. Although we're achieving a lot politically, I'm worried about whether we really figured out how we're going to make this work practically.

Adam Tooze — We've witnessed recent upsurges of popular discontent, obliquely related to a carbon tax. In France namely, one of the climate leaders in Europe, the hosts of the 2015 conference, we had the Gilet Jaunes protests, where attempting to raise the price of fuel ran into a storm of public opposition. To me this relates to the more general question of what it is that we mean by leadership, for democracies. I understand your point Laurence, that there is a constituency in Europe, which is young and dynamic and promising, and you can see why politics will swarm around that. But as Alex is reminding us, there are also those groups who feel disenfranchised, and for whom the blessings of a carbon tax and the gradual movement away from cheap diesel fuel are far from obvious. Perhaps Laurence, you can give us your take on the Gilet Jaunes and the specifically European problem of leadership there.

Laurence Tubiana — Of course, that had a huge impact and it hasn't been totally absorbed by French society. The origin of the movement was a petition claiming the carbon tax wasn't fair because it had a regressive impact on modest income households who couldn't find an alternative to fuel. The price of energy for modest households is relatively much higher than for a well-off person, who doesn't care about a one cent, or five cents increase in the price of gas. At the same time, many Gilets Jaunes have said they were not against ecological policies, but against unfairness and injustice. To decrease emissions by something like five or 7% a year, which is what is needed, by 2030, is an immense transformation of the economy in every way. The question of social justice is essential not only for acceptability, a term I don't like much, but because of citizen involvement in the decision. Because of the yellow vests, Macron finally accepted the suggestion some of them made to have a discussion on climate policies that would really put social justice at the forefront. The subjects proved to be very ambitious, whether it be regarding the quality of transport, building policies, renovation, etc. But they always demanded social justice and fairness to go with it. That's why they wanted flights to be taxed rather than cars for example. They wanted the price of housing renovation to be compensated for low-in-

come households. Climate policy cannot be a unilateral, top-down strategy. Carbon pricing it's useful, but as the impact assessment of the Commission has demonstrated, simply extending the carbon market will have huge regressive impact on lower income households. We would rather the citizens be active for this climate policy to develop. This would imply change in the way our democracy's function. If you don't give citizens a voice, a capacity to decide at a local level and even a national level, this transformation will not take place. There will always be a lobby's incumbent to say that it cannot be done now, which is exactly what is happening in many countries now, including in France. Having the citizens be actors in the transformation, is a condition without which such a deep transformation can't occur.

Jason Bordoff — We've done a lot of work at the center of global energy policy on carbon tax design. The question of whether a carbon tax is progressive or regressive depends entirely on what you do with the revenue. So, it's hard to distinguish the policy instrument from the use of the revenue in terms of its regressivity. I think the broader point, echoing what Alex said, is to think much harder about the political economy barriers to more ambitious climate action. And a big piece of that is going to be who the losers are, not from what we've seen so far, which is a modest carbon price, or even a decline in coal in some, you know, OECD countries, but from large-scale transformation of the global energy sector. If you imagine what happens to the global energy system, if we get on track, with well below 2°C, where we're nowhere close to being today, what does that look like? And as you know, if we run the existing fleet of global coal plants to the end of their normal economic life, we blow through the Paris climate goals. You're talking about retiring existing infrastructure early that has wide scale economic impacts, and not just in the US where 50 or 60,000 people work in the coal industry or in Europe, but in a country like India, where half a million people work as coal miners and another million, I think work for Indian railways, the largest civilian employer, with coal providing nearly half of the firm's freight revenue and subsidizing the cost of passenger rail. It's enormously disruptive as a matter of economic policy. I think all of us need to think harder and work and work economic development and economic policies to detail what a more rigorous set of solutions is like. I'm afraid if we don't take that seriously enough, those political barriers will make it harder to move ambitiously on climate.

Alex Halliday — I think that's a massively important part. But at the same time, we need to move fast. We've got targets to set deadlines, but the motion has been relatively slow in terms of getting companies and governments to change what they're doing. It's been impressive seeing the European Green Deal lay out, on an almost monthly basis, what is to be done, what the next bit of

the plan is. It's impressive to see this global leadership emerging. And at the same time, the question is, when are we going to see the major energy companies really engaging with us? They have begun engaging against climate change but the question that many people have is, to what extent is that engagement lip service? Or to what extent are they really going to change? How are you going to deal with Saudi Aramco, these super overproducers, hydrocarbon producers? And then of course the big numbers in terms of coal, America, India, Turkey a fair bit, but especially China.

China talks about getting rid of coal and power stations, and not building as many, because of pollution and the effect it's having on their atmosphere—But they're quite happy building them for a Belt and Road initiative in other countries. It's got to be taken to a much more serious level, really getting people to understand the grave urgency of what's happening. We are heading not just towards worsening the climate, but into uncharted waters in terms of understanding how the climate will respond. Based on previous times in the geological record, when we know climate CO₂ was this high, it really looks grim. We must face up to the fact that we could be moving into this relatively quicker than it's ever happened in natural times in the past, imposing huge shocks on our ability to deal with nature. We all know how good we are at preparing for huge shocks. I think we need to really take, a serious sense of how we've dealt with Covid and how unprepared we were, despite all the things that were said in the past about getting ready for a pandemic. Think about that in the context of what's going to happen with climate change, which is going to be far worse and for far longer. There won't be a vaccine or anything like that. We're moving to a point where the climate system is going to be in certain respects irretrievable as we accelerate forward.

Adam Tooze — You mentioned China. China is responsible for as much CO₂ emissions right now as the United States and Europe put together, in fact more than that. It has finally made a major announcement on its climate trajectory. Is this not a fundamental issue for Europe also for the United States going forward? Italy has at various points, adopted a line towards China that was rather different from that of other European States. Indeed, I believe that Italy is a signed-up member of One Belt, One Road Enrico, how do you see Europe's relations with China going forward on this front.

Enrico Letta — I see one tool, one framework, one opportunity next year, because next year Italy will lead the G20 and the G20 is the only place where China and the US are there at the same table. The G20 isn't like the UN general assembly, it is a small table and it's a very important place and institution. In last year's context of crisis,

in 2020, the role of G20 was somewhat minimized. I think next year's G20 can be important. First, there's a new US administration and the 2 G's, the G20 and the G7, had a lot of problems with Trump, of course not being a big fan of those kinds of meetings. So, I think the G20 can play an important role next year. It is not by chance that the Italian presidency will put planet, people, and prosperity as the three key words of the program. At the same time, it's the year of the Glasgow meeting and Italy will co-chair with the UK. I see that as an opportunity for Europe to engage with China and to keep discussing these issues with them. Of course, it depends on many other technological issues, security issues, and so on and so forth. It also depends on Biden's agenda on China. Frankly speaking, it's not easy to understand whether Biden's agenda will be in continuity, with Trump's agenda on China or not, however I feel the G20 is the first opportunity to see if multilateralism will resume with the new US administration.

Adam Tooze — Laurence, if you were in the room and you had command of the agenda, what is it that the Europeans should discuss with the Chinese? What do you think should be the key agenda points for that conversation?

Laurence Tubiana — As you know, The US-China discussion was very tense in the preparation of the summit, the EU-China has been postponed time and time again. There are many issues to be discussed: investment, the trade issue, the issue of technology, human rights, and climate. That's why Europe standing up, saying it will go through with the Green Deal, no matter what others may want, to the point that it may use a trade instrument to be able to deploy the Green Deal fully, is essential. Merkel and Michel have been preparing scenarios that they could ask China to accept with the hope that climate may at least offer some ground for consensus. And that is why Merkel moved the target for net carbon neutrality forward to 2016. Of course, this discussion with China was well prepared, China has people that are working on the subject. But I do think that for Xi it was damage control certainly. The problems the Chinese are facing now (and I've been going to China every year since 2000) are trade measures and the border tax that are just a nightmare. So, they've seen this coming, which is why they are now so excited about the carbon market, both internally and internationally.

I think another element which I think explains the poor result of BRI in terms of international soft power is the debt issue, which is increasing. China's position has been ambiguous. In September, China promised to be carbon-neutral by 2060, which was our first demand. But now I see a sort of gray zone where China hasn't come up with anything new on the 12th of December summit for the fifth anniversary of the Paris agreement. They could

have come and announced the new climate plan. None of their suggestions were strong or even clear. It was just business as usual, mostly. Now the EU must ask what the second step before Glasgow is, and that's where the discussion between EU and US is so crucial. If Europe and the US decide on an economic trend that converges on the climate element it could have a major, and rapid impact. Such an agreement could change the course of the global economy, as it would have an enormous impact on the two biggest markets. A path that could lead us to pushing China to modify its policies could, the path taking us from the US through Brussels to China the Biden agenda could thus be quite different in a sense than that of the Obama administration, as Obama was not actually interested in European development, and had its eyes turned mostly to Asia. So that's the pivot point that I don't know if Joe Biden will embrace. It could give us enormous leverage in China, but if we fail to do that, I'm sure China will continue to delay any action.

Adam Tooze — That's fascinating. Jason, as an American, what's your read on the direction Biden team's travel direction?

Jason Bordoff — I'm unsure. As you say, the US and China combined account for half of global emissions. So diplomatic dialogue and the elevation of climate ambition is essential in that relationship. You explained in Foreign Policy, why the 2060 announcement was important. Everyone is looking for indications that things in the 14 five-year plans in 2030 targets will be meaningfully different and give some confidence that long-term targets are real. There'll be some return to trade norms and maybe that will help increase trade in energy and clean energy products. We're going to need a lot more of that, but this is a very difficult and contentious relationship, and that's going to remain true under President-elect Biden. Also, numerous issues such as cyber security, intellectual property theft, unfair subsidies, political repression, and human rights clearly complicate the US-China relationship. As Laurence said, there's an important element of soft power, in Belt and Road. President Biden used very strong language throughout the course of the campaign about BRI and, and explicitly extended phrases like holding China accountable for its investment in coal projects like Belt and Road outside of China. Although we don't exactly know how one would do that, I think one tool the US has now in 2018 is the creation of the Development Finance Corporation, a more powerful version of its predecessor. You can't beat something with nothing. If you want to complain about some of the geopolitical or environmental impacts of Belt and Road, there need to be efforts with multilateral finance to go into rapidly growing South Asian or other emerging market countries and say: we can put a package on the table that works economically, that makes sense from a financial standpoint, and is cleaner, is lower carbon. That's an important area where the US

and Europe can work together with multilateral finance institutions. I do think we've also seen some indications of what that would look like. Our incoming national security advisor, Jake Sullivan, wrote a piece in *Foreign Affairs* recently about incremental change, shifting towards an industrial policy targeting strategically important sectors, clean energy certainly being one of them, and making sure that the US is competing economically with China at the same time.

Adam Tooze — That's an interesting dialectic between cooperation and conflict. Do you prefer a sort of competition of systems, which has the net effect of achieving the kind of crash decarbonization that Alex is rightly insisting we need? Or should we think of this as part of a project of building cooperative, global relationships, rebuilding multilateralism?

Laurence Tubiana — I think it would be the combination of the two—look at the automotive industry, where competition is very fierce. German industry has shifted. The monster Volkswagen has decided that the traditional car engine is obsolete. But at the same time the fact that it's now or never issue can justify introducing competition into the equation. That's why I really think that if there is some convergence between US and Europe on what the decarbonization trajectory should be. It's a very mixed model. The economic trend will not be linear because we will have crashes and crises in some sectors. I think there will be a by this massive shift of markets. The Chinese component itself is quite unstable, as it'll have to face a debt. China has at times been a global leader in the discussion on impact of climate change and at other times quite absent. These numerous instabilities are why I believe that a signal from the market, from the companies, from the investors, from the governments, could help lead to an alignment. I think that will be an irresistible signal for China to be serious and to stop postponing the decision, as Jason was saying. When you look at what is on the table of the 14th 5-year plan, it's not consistent with carbon neutrality by 2060. That's why it's so urgent for the signal from the US and the EU to be the same.

Adam Tooze — Alex, do you want to come in on this?

Alex Halliday — I think that was a great answer. Trying to incentivize a shift to climate-friendly solutions is somewhat of a chicken and egg problem. So for example getting an electric vehicle right now in New York is pretty much a waste of time. There aren't any charging places on the streets or any garages. The old-fashioned gasoline car is so much more practical. And so, at some level of government, whether it's state, city, or national government, they did a huge amount to catalyze this change and now the automotive industry is ready to make it, to pump

out new forms of vehicles. Bentley's doing it. So is Volkswagen. There's a lot of enthusiasm. The big manufacturers in America say they can move in the same direction. But we've got to get the country to provide the infrastructure to really support this leap forward. De-carbonizing buildings is a similar issue. Someone's got to step in and make it happen at a government level, whether it's a state, city, or a federal level.

Adam Tooze — Yes, one of the optimistic signs that you can read—it's under reported, I think, is that the European carbon trading system is beginning to bite right now. The price of over 30 euros a ton is really beginning to hurt the polls. It's no longer math, it's really politics. It's a matter of whether you want to lose money making power or not. And if the European Union has the guts to progressively limit the supply of allowances, we could see prices nearing 70 or 80 euros a ton over the next decade. And at that point, the momentum that Laurence was talking about seriously begins to build. Maybe I can end with this question. Enrico, looking back at today 15 to 20 years from now, do you think this will prove to have been the turning point we need it to be? Because going into the year, I would have said that I felt pessimistic. I would have said, I understand the political economy of climate change and it looks bad. There really isn't the energy, the force that we need to look at the emissions numbers. It's just not there. The action isn't there.

However, I think I agree with Enrico in saying that this year didn't turn out the way we expected. As the historian trying to position our moment, it's my kind of emotional intellectual hedge against disaster to at least tell the story of how this happened. How do you evaluate this moment Enrico?

Enrico Letta — I think I suggest you, as a historian, work on the three main events of 2020, the first event being the change in the US administration. That is crucial. I think the second one is the announcement made by the Chinese leadership. And the third is about Europe. In Europe, the key point is the public opinion shift, which is crucial because, as Laurence said, politics are soon to follow. I think the youth movement was so important because at the same time Europe was facing a dramatic increase of debt which we were asking the present youth to pay back in some decades. I think the present leadership and the present generation in power are thinking that there's a deal to make with the new generation. And that deal implies an increase of debt. So, more responsibilities for the new generation. Now we must be responsible for the climate because the new generation is asking us to take on this responsibility. Those three simultaneous events explain why I think 2020 is so crucial.

Adam Tooze — That's fascinating. So, I hate to cor-

rect you on the debt, but the debt problem seems to be a mostly American problem. No one else is running an 18% of GDP debt deficit, according to IMF numbers. America's debt accumulation this year is that of all the advanced economies and China put together. But it is a common problem.

In other words, we are, as Alex was saying, doing things on a stupendous scale, the question is whether we can make them valuable in the long-term. Jason, when we look back at this year, do you think it will, at least in the American case, be an opening to some fundamental shifts?

Jason Bordoff — There's certainly a shift happening. The issue of climate change is clearly playing a more important role in the political elections. I see it on campus every day. A sense of urgency among the younger generation. And you see that in the polling on both sides of the aisle. They're starting from a different place, but for the younger cohort, this is a much higher priority issue than for the older generation.

Adam Tooze — Even amongst self-identified Republicans.

Jason Bordoff — Yes, that's true, it is changing. This is a really important year for so many reasons. Another event this year is the 50th anniversary of Earth Day in the United States. The first earth day in 1970 came after several decades of air pollution, water contamination, and lack of regulation of the industrial sector. People were breathing dirty air, there were signs saying don't swim in this lake because it's polluted, you can't drink the water. It came to a head where one out of every ten Americans across suburban and urban areas, across Republicans and Democrats, came into the streets in April 1970 and said, we just can't live like this anymore. Somehow, you must fix this problem. So much so that the political pressure built on a Republican president, Richard Nixon leading him create the EPA and the clean air and clean water act. I think we're moving in that direction with the sense of urgency around climate, but I'm not sure where we're all the way there yet. I think there's still some more work to do to understand the urgency and the scale of transformation required. When we talk about the energy transition, I think people often put a chart up showing something like zero to a hundred percent going back to 1850, and then you see these great transitions from wood to coal and coal to oil, oil to gas, increasingly renewable, although still minimal if you look at that same data, not as a percentage of the total, but rather in terms of total energy. BTU's, that's what the climate cares about, tons of CO₂. We've never used less of anything. We're using more of everything today than we did a hundred years ago. And so, everything we're talking about is an example of how we could see a clean energy transition, meaning all the new energy de-

mand will be fulfilled with zero carbon energy. We're still going to need massive amounts of negative emissions given what the models show at this point to meet the below 2°C target, given how long we've delayed. We also need to confront the fact that 80% of the global energy mix today is hydrocarbons and that must come down quite a bit, but maybe there's some role for CCUS. We're talking a lot about electricity. How do you put more renewables on the grid? Electricity is 20% of final energy consumption, about a third of emissions. There's a lot that we can electrify, but we're not going to electrify all of it. We need more innovation in a hard to abate sector. More urgency is insufficient, we need to confront what it really means to take that urgency seriously.

Laurence Tubiana — The US picture seems very complicated, but I understand that even the polls show that a majority of US citizens are concerned with the issue. It may not be like the seventies when a million people were in the street, but nonetheless it's growing. I too was very pessimistic last March. I was afraid the crisis climate would end upon the back burner but the general response, saying we must recover differently, we must recover green, although sometimes it's just lip service, it can also be a real response. The investment portfolio move against oil and gas companies is not linear. The fact that the share values of the gas companies are going down, is a massive as an indicator. So yes, I would say that it may have been the year of the shift. Again, I have no idea if we can win the battle. I'm not sure if we will, because we are just so late, but I do think that this year is a new shift. That's why I'm more optimistic today about the resilience and impact of the Paris agreement than I was eight months ago.

Alex Halliday — Although I've been negative through most of this discussion, I do feel tremendously excited about European Green Deal. I think it's fantastic to see a concert on the European scale taking this on seriously as a common challenge. I do think there's cause for optimism now that America's going to be turning back to the table. I think another cause for optimism is the fact that people recognize that there are opportunities. There are the young people wanting it, but there are also opportunities for people in the future in terms of new kinds of industries and jobs. Although we really must think hard about those coal communities and what this will mean for them, this transition. Let's think about it in terms of jobs for those people and new opportunities for them that we can strategically target in certain sectors of our economy such as new technologies. Negative emissions are also massively important, we're not going to get there without that. That's going to require large-scale infrastructure, technology where lots of money is of course to be made. It's also going to require an ability to move CO₂ around and bury it underground. For that we're going to need to work with the oil and gas industry. They're the only

people in the whole world who know how to do this. And so, there's an opportunity for them to take part in the transition. So, I do think there are ways to think positively about this transition although

I'm nervous we may be feeling too comfortable about how things are going rather than feeling nervous and scared as we should¹.

1. The GREEN Review presents a condensed and edited version of the conversation on Europe's role in combating climate change hosted by Adam Tooze last December as part of the 'Debating the Future of Europe' cycle, already published on 10 April 2021 by Le Grand Continent. This series of debates, of which the Groupe d'Études Géopolitiques is a partner, is jointly organised by the Parisian centre of Columbia University, its European Institute and its Alliance Programme.



David Levaï • Former climate negotiator at COP 21, associate researcher at IDDRI (Paris) and at the UN Foundation (Washington)

Climate as an Answer to America's problems

Right after he took office on January 20th, the new American President, Joe Biden, wanted to make clear that responding to the climate crisis would be one of his administration's priorities. Identified during his campaign as one of the four crises that will shape America's present and future¹, he made it the subject of its first official speech. The day after the presidential election, even while the outcome was still uncertain, the Democratic Democrat candidate denounced the American withdrawal from the Paris Agreement, which had gone into effect on November 4th. He promised a return, without fanfare, 77 days later, which he carried out through his first presidential signature on January 20, 2021, effective as of February 19th.

Beyond its symbolism, the United States' return to the Paris Agreement marks a revival of multilateral cooperation on climate, which had suffered under tensions exacerbated by the election of Donald Trump four years before. Seizing this moment offered the opportunity to demonstrate how well prepared the Administration was to lead the country on the road to carbon neutrality: through successive appointments, speeches from members of the government, and instructions given to government agencies, the Biden team intends to show that it is not only aware of what is at stake and the forces at play, but also that it is prepared to take up the challenge at both the national and international levels in order to ambitiously respond to and meet expectations. It remains to be seen whether the President is ready to invest his political capital in this.

With this initial display and an avalanche of new promises, the United States is already attempting to catch up. China had caused surprise by announcing in September 2020 its intention to reach carbon neutrality by 2060, one

1. Along with the Covid-19 pandemic, the economic crisis and systemic racism.

decade after the European Union, at a moment when the United States was still denying reality. At that time, the Democratic candidate was already displaying ambitious intentions – to make U.S. electricity production carbon neutral by 2035 and its entire economy carbon neutral by 2050 – following a trajectory parallel to the European Union's. Since then, these plans have been confirmed by the new President in a new climate contribution (NDC)² which was drawn up in record time and deemed both ambitious and realistic, as well as a multi-year plan for international public funding³.

Thus, on April 22, 2021, five years to the day after the signing of the Paris Agreement on the podium of the United Nations in New York in front of President Hollande and the Secretary General then, Ban Ki Moon, the new American president wanted to make his mark by organizing the first Leaders Summit on Climate, exclusively dedicated to the climate crisis. Among the forty countries invited were the world's seventeen leading economic powers. But the spotlight was on Washington as Joe Biden presented new American commitments for 2030. The national effort will live up to the expectations of civil society as it aims to reduce GHG emissions by 50% to 52% compared to 2005. It is a victory for activists and an undeniable success for the United States.

The same day, a new climate financing plan ordered by the White House was unveiled. Despite a clear political will, in a political context that is not very conducive to international financing, the plan's content is disappointing. The announced amounts of 5.7 billion dollars per year by 2024 are far from what is needed to catch up with European leaders (UK, DE, FR) who will have quadrupled their financing in the ten years between 2015 and 2025⁴. How credible are American pronouncements if their elected officials are unable to mobilize the necessary resources?

None of the United States' partners have forgotten the back-and-forth of the last decades⁵ and America's frequent reversals during the political changeover in Washington. If American climate ambitions leave some partners sceptical, many want to believe in the political will of President Biden. The Congress, that the President needs to legislate, is strongly divided, and even if a majority of Americans want more federal action on climate⁶, the issue remains

2. The United States' Nationally Determined Contribution. *Reducing Greenhouse Gases in the United States: A 2030 Emissions Target*, April 15, 2021.

3. *U.S. International Climate Finance Plan*, White House, April 22, 2021.

4. Michael Igoe, "Biden announces US will double climate finance by 2024", *Devex*, 22 April 2021.

5. The Clinton administration negotiated the Kyoto Agreement in 1997, but the United States never ratified it. America turned away from climate multilateralism during the Bush years (2001-2008) before returning to it under Obama (2009-2016) and signing the Paris Agreement. D. Trump decided to leave it in June 2017. J. Biden re-entered the Paris Agreement in February 2021.

6. According to a Pew Research Center study in late 2019, 2/3 of Americans believe the federal government is doing too little to combat the effects of climate change. See Cary Funk & Brian Kennedy, "How Americans see climate change and the environment in 7 charts", *Pew Research Center*, 21 April 2020.

highly polarized⁷. Given this situation, how can Joe Biden convince people that his good intentions are sustainable and that he will be able to set America on a path towards carbon neutrality beyond his first term? The main question that Democrats will have to answer quickly if they hope to restore American climate leadership is how to make it an issue that Americans care about in the long term?

Making climate the new frontier for public action

Joe Biden aims to anchor climate at the center of American policy. He hopes to solidify climate action through reshaping policymakers' profiles and changing government processes.

Some American commentators have expressed surprise at the green transformation of the radically centrist candidate Biden into the deeply progressive President Biden. Each of the more than 20 Democratic candidates during the primary campaign had made the climate crisis a central part of their campaign, some even making it the top priority for public action.

While the climate issue was absent from Hillary Clinton's campaign in 2016, in just a few years it has become the cornerstone in the fight for new rights and social justice. Faced with the constant dismantling of environmental regulations in the Trump era⁸, climate action has become a rallying cry of progressives. Political polarization has made it a clear message for the Democratic camp that all of its representatives have embraced, including the most moderate of them, Joe Biden. Once the primaries were over, the Democrats had to come together and develop a policy agenda within the Unity Task Force that could win popular support⁹. Climate was the first focus, and it was John Kerry (from the Biden camp) and the progressive icon, Alexandria Ocasio-Cortez (from the Sanders camp), who forged a common vision in which the fight against the climate crisis would be a catalyst for greater social justice.

During their time in the opposition, the Democrats laid the groundwork for a new direction, actively working to bring foreign policy and national security specialists closer to the climate community. This effort sought to overcome the Obama administration's lack of coherence. Despite its national and international climate ambitions, the Obama administration did expand fossil fuels in the

United States with the fracking boom while promoting American gas abroad, particularly in Europe, in the face of Russian expansionism.

Through a number of initiatives, such as those led by the National Security Action or the United Nations Foundation¹⁰, many of the future members of Joe Biden's foreign policy team have been trained in climate issues, particularly those that fall directly under their diplomatic or security expertise. Now in office, those experts have climate action as their compass, along with security, soft power, or human rights.

This systematic commitment to placing the climate crisis at the heart of every public policy was also evident in the Biden administration's leadership appointments and their first decisions. Joe Biden was clear from day one: the climate issue requires a comprehensive response in all arrays of government action, from foreign policy to trade, from national security to agriculture, from transportation to fiscal policy. That is what the Americans call "a whole-of-government approach". Each sector of the US economy must initiate, accelerate, or deepen its transition, and the federal government must act as the catalyst.

Thus, each of President Biden's top aides, undisputed experts in their fields, have both a strong exposure and sensitivity to climate issues. They intend to better integrate climate in their portfolio. This is natural for positions that are traditionally concerned with steering climate action. Michael Regan was chosen to lead the Environmental Protection Agency (EPA), a man who occupied this role in the state of North Carolina and is known for his actions in favour of disadvantaged populations, and his emphasis on justice and equity issues. Jennifer Granholm, former governor of Michigan which is home of the automotive industry, was appointed as Secretary of Energy to lead the electric vehicle revolution. Debra Haaland, the first Native American secretary, as head of the Department of the Interior, is responsible for managing and preserving federal lands. These appointments reinforce the idea for both supporters and opponents that these departments will strive to pursue ambitious policies on modernizing the electric grid, transforming the energy mix, or limiting fossil fuel extraction.

At the White House, the President is striking a greener tone with the creation of two special envoy positions, with their own teams, serving in the Cabinet – the equivalent of the French Conseil des Ministres. Two former Obama officials, John Kerry (for international affairs) and Gina McCarthy (for domestic affairs), are now responsible for turning presidential words into action.

However, the most visible difference comes from positions not directly or traditionally linked with climate is-

7. Between 2013 and 2020 the percentage of Americans who consider climate change a threat rose from 40% to 60%. However, the change occurred mainly among Democrats, from 58% to 88%, while the proportion among Republicans went from 22% to 31%.

8. More than a hundred environmental regulations have been removed by the Trump Administration - including standards for CO₂ emissions from vehicles, methane emissions from the oil industry, and the powerful warming gases HFCs from refrigeration. See Nadja Popovich, Livia Albeck-Ripka and Kendra Pierre-Louis, "The Trump Administration Rolled Back More Than 100 Environmental Rules. Here's the Full List", New York Times, 20 January, 2021.

9. Biden-Sanders Unity task force recommendations. *Combating the climate crisis and pursuing environmental justice*, JoeBiden.com, August 2020.

10. See Climate in foreign policy project (CFPP), United States Foundation.

sues. There have been firm, determined, and unequivocal statements on the threat posed by climate change and the specific role each branch of the government has to play. Both the Secretary of State – Anthony Blinken – and the Director of Intelligence – Avril Haines – stated in their Senate hearings that climate change will be a foreign policy and national security priority. The Secretary of Defence, General Lloyd Austin, has launched an internal review to better assess climate-related risks both to military infrastructure and deployment as well as its potential to increase threats and conflicts. On December 12th, the day of the fifth anniversary of the Paris Agreement, the National Security Advisor Jake Sullivan, whose deputy is Jon Finer, a former Chief of Staff for Secretary of State John Kerry, reaffirmed his view that “the climate crisis is a national security crisis for the United States”.

The US Trade Representative, Ambassador Tai, believes that U.S. trade policy must combat climate change and help protect the planet and not the other way round. This would entail ending the export of American fossil fuels, a little revolution. Janet Yellen, Secretary of the Treasury, is building a dedicated team around her, a first in the U.S. treasury. The list is long and includes Brian Deese, champion of green finance and now Director of the National Economic Council (NEC), Pete Buttigieg, unsuccessful candidate in the Democratic primaries and now Secretary of Transportation, and Biden’s own chief of staff, Ron Klain, all of whom have long been sensitive to climate issues.

In its first weeks, the White House aimed at demonstrating its seriousness and level of preparation by tasking all its agencies to launch reviews of ongoing policies and plans to integrate climate issues or constraints more effectively. A presidential order mandated agencies and departments to investigate the issue and to quickly come up with concrete proposals to integrate climate into issues such as foreign policy, defense and national security, export financing, and development assistance. It also mandated the various branches of the U.S. government to use any means at their disposal, from licensing to government contracts. All these efforts are under the responsibility of an intergovernmental task force, led by Gina McCarthy, which meets monthly, whose work is public, and which brings together the heads of twenty-one federal agencies, a first in this country.

Taken together, these political appointments form a coherent vision: every public policy decision or instrument will have to integrate the climate crisis, respond to it and try to contain it. At the Leaders Climate Summit, hosted (virtually) by Joe Biden on April 22nd – Earth Day – no less than eighteen officials or senior members of the administration spoke. The primary purpose of this show of force was to assure foreign officials of the U.S.’s political will and the credibility of their commitments. This

includes the more cynical ones for whom the 2022 mid-term elections could put an end to the Biden administration’s ambitions. It was also about reminding Americans that the climate issue is crucial and affirming the transformative ambition of his government. By reshaping the structure and functioning of his Administration in order to integrate the climate issue at all levels of government, Joe Biden hopes to make sure that the efforts already underway continue beyond the end of his term, even in the event of change in political rule.

Climate, a foundation of the political response to middle-class challenges

Ensuring the longevity of political decisions that pave the road to carbon neutrality requires building a solid consensus in the public opinion. Choices to be made in the coming years regarding energy production, transportation, land use, urban expansion, agriculture, or industrial practices will need to be perceived by a majority as beneficial to America and its middle class rather than a necessity for the planet. The Biden Administration’s challenge is to make climate action a major part of the response to the problems that affect all of America and its citizens. It must not only be a vehicle for jobs and growth, but also for social justice racial justice, and equity. Three main areas of focus have been identified: environmental justice, just transition, and jobs.

Environmental impacts often discriminate against the most disadvantaged populations. In the United States, minorities, particularly African Americans and Native Americans, have been victims of endemic air and water pollution at the local level for generations. Environmental justice intends to correct this by paying particular attention to the plight of those who have suffered the most from this damage, as well as how they will be affected by the climate response. It is for this reason that some progressive voices reject the “polluter pays” principle, which would “endorse” certain types of pollution as long as the polluter can pay the final bill, regardless of the social or human costs. That is why there does not exist today widespread support of the idea of a carbon tax among progressive Democrats, even if some, like AOC, admit that it could be part of a range of solutions.

The transition to carbon neutrality implies the transformation of all sectors of the economy, in particular the energy and industrial sectors. Their transformation will have a high cost in terms of employment and certain regions of the United States – such as West Virginia with its coal mines, or Ohio and Pennsylvania with their shale gas wells – will be a victim to this desindustrialisation process. Ensuring a just transition means limiting its harmful effects by massively investing in support and retraining of workers. The prevailing social vision is that blue collar workers should not have to bear the cost of this transition

alone, it should be society as a whole, since it is a collective choice.

The two pillars of social and environmental justice are obviously at the heart of the major infrastructure plan presented by the Biden Administration and submitted to Congress. But the White House is seeking to go even further with the American Jobs Act, which has a budget of more than two billion dollars, by making the green transition the answer to the main concern of Americans: ensuring quality jobs that pay decent wages. This plan highlights the opportunities that arise from fully investing in the low-carbon transition. Jobs, economic growth, and innovation will be its foundation.

Joe Biden's challenge is to demonstrate in less than one term that the transition to a carbon-free economy is the only possible path forward for the United States, and that this path will both bring higher wages and reduce inequalities. The credibility of U.S. commitments is also at stake. The repeated 180° policy shifts by successive administrations over the past twenty years have shown the urgent need to enshrine any progress or new goals into law so that a change in administration does not mean that a President can simply abandon the path that was established.

For certain countries which are major emitters, especially in Europe, the desire to reduce greenhouse gas emissions and to determine an acceptable pathway to carbon neutrality has led to major legislation: the European Green Deal (2019/20), the British Climate Change Act (2008), the French Energy Transition and Green Growth Act (2015), and the German Climate Protection Act of 2019, which has just been overturned by the Constitutional Court for not being ambitious enough. We should not expect the same in the United States, i.e. an overarching "climate" plan, covering all sectors while setting binding targets and deadlines. Although it is not called as such, climate action is deeply rooted in the large infrastructure plan that is the American Jobs Act. The semantic shift from climate to infrastructures to jobs illustrates the Democratic strategy of using climate action to address the problems of today's America, especially for the middle class. The climate approach will allow the modernization of decaying infrastructure, strengthen the reliability and resiliency of the electric grid, create millions of good, decent-paying jobs, reclaim American leadership in innovation, and ensure quality public services.

This "American Jobs Project" plans to commit considerable funding over the next eight years to shift the American energy system towards renewable energies in order to reach the goal of completely carbon-free electricity in the next 15 years. \$100 billion will be spent to strengthen the electrical grid, accelerate electricity production from renewable energy, and convert jobs in the fossil fuels industry to eliminate methane leaks from old

coal mines or oil and gas wells. \$174 billion will be used to convert the automobile fleet to electric vehicles, through support for the automobile industry, the deployment of 500,000 charging stations, and the conversion of 20% of school buses (by 2030). As for energy efficiency, which is lacking in American buildings, an additional \$213 billion will be mobilized to build or renovate over two million homes and commercial buildings. In addition, to ensure that public spending is consistent with the goal of decarbonizing the economy, the Biden plan seeks to eliminate the tax breaks and subsidies that still benefit fossil fuels industries.

This vast project is not only about increasing the resilience of America's ageing infrastructure, but also about investing in the workforce. Since he took office, Joe Biden has been driving home a single message: "jobs, jobs, jobs"! The White House's comprehensive approach, which is applied across all government agencies and departments, aims to provide concrete answers to the concerns of the middle-class such as ensuring quality jobs – meaning jobs that are sustainable, well-paid, and protected or unionized – and reducing inequalities while laying the foundation for a shared vision of a carbon-free tomorrow. Making this connection obvious would allow President Biden to secure the support of a large majority of Americans and to ensure that the transition was permanent. Beyond anchoring the transition in legislation, this is how Joe Biden hopes to show the rest of the world the legitimacy of his approach and the long-term nature of American commitments through popular support – as the Democrats did with the Affordable Care Act (the official name of "Obamacare") in its time.

Conclusion

In an America traumatized by record unemployment last year – unseen since the Great Depression – the issue of jobs is a unifying theme and a rallying cry that can unite America, helping to make climate action durable. Like China, choosing the path of carbon neutrality to satisfy one's own interests and ensure one's economic and trade leadership is a powerful argument for mobilizing all parts of American society.

A renewed American leadership on climate requires actions beyond words. The road is straight, but the slope is steep... and fraught with perils. There is real risk that the legislative branch will curtail the executive branch's transformative ambitions and ability to act. The latter will still be able to count on grassroots movement within American civil society, those enterprises and communities that are choosing to embark on the path to carbon neutrality. While they contributed to a significant shift in public opinion during the Trump years, these initiatives do not have the necessary scale to transform the American economy without federal support.

The Biden administration has already demonstrated its seriousness and preparedness. Aware that more will be needed to convince its international partners of its capacity to stay the course beyond the next three years, it

hopes to offer a vision of America that goes beyond political divisions to make carbon neutrality an unattainable goal.

02



The Challenges and Contradictions of China's Ecological Transition

What is the Future of Energy in China Given its 2060 Carbon Neutrality Goal?

◀ **Boris Svartzman** • Franco-Argentinian filmmaker, photographer, and sociologist. Doctoral candidate at the Research Center on Modern and Contemporary China at EHESS (l'École des Hautes Études en Sciences Sociales) in Paris.
www.svartzman.com

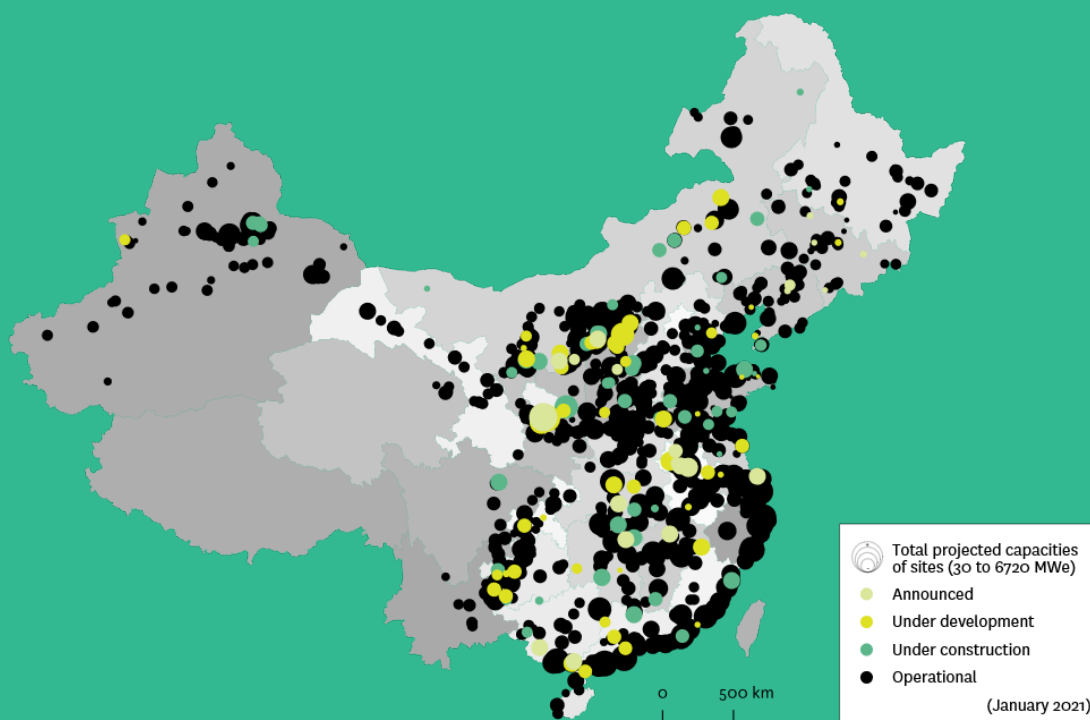
Photo from the series "China in Change" / "Chine chamboulée" (2008).



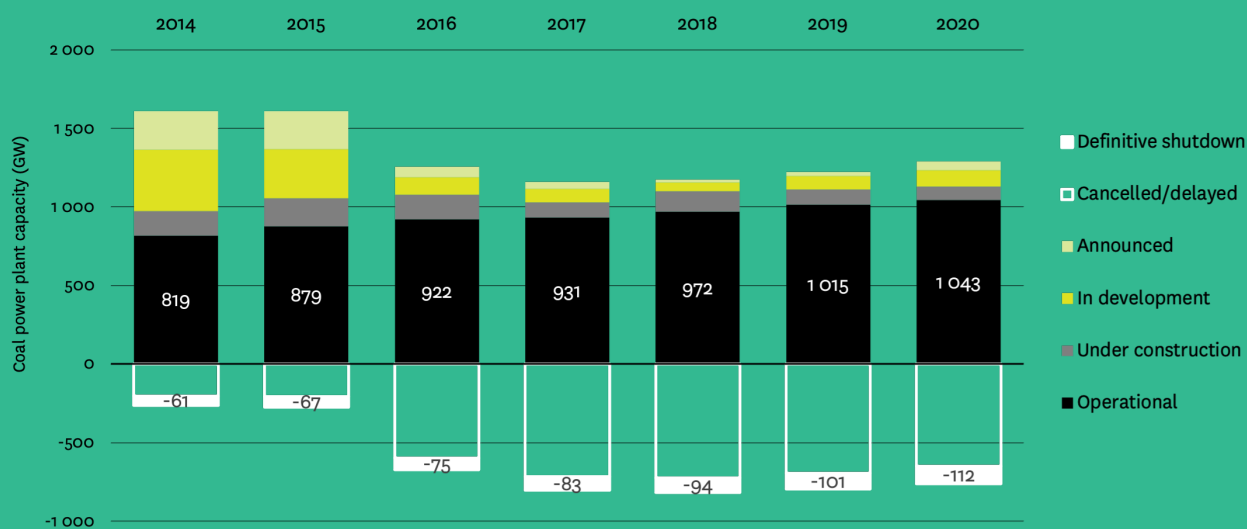
Amélie Latreille • GREEN editorial comitee
Léa Boudinet • GREEN co-editor-in-chief
Clémence Pèlerin • GREEN co-editor-in-chief

China: The World's Largest Consumer of Coal

1. Location of chinese coal-fired power plants¹

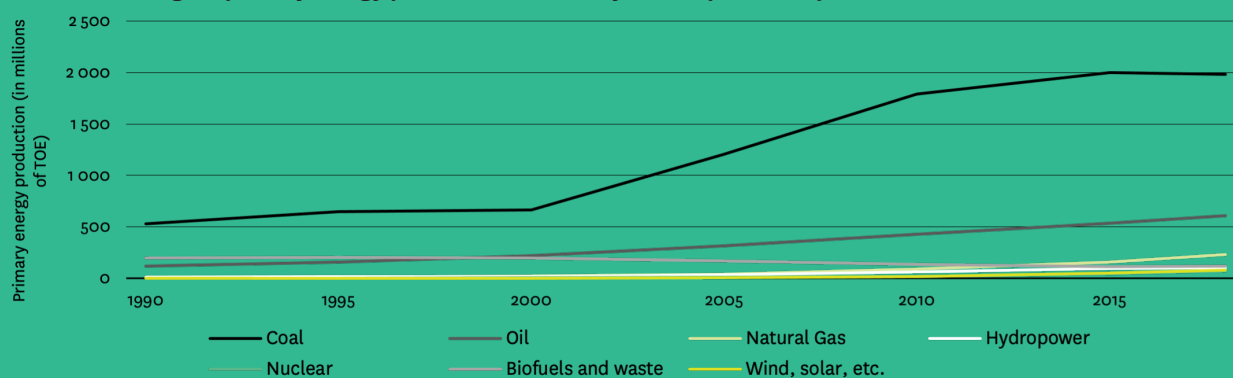


2. Development, construction, and decommissioning statistics for coal-fired power plants in China (2014-2020)¹



1. Source and ownership of data : *Global Energy Monitor*, *Global Coal Plant Tracker*.

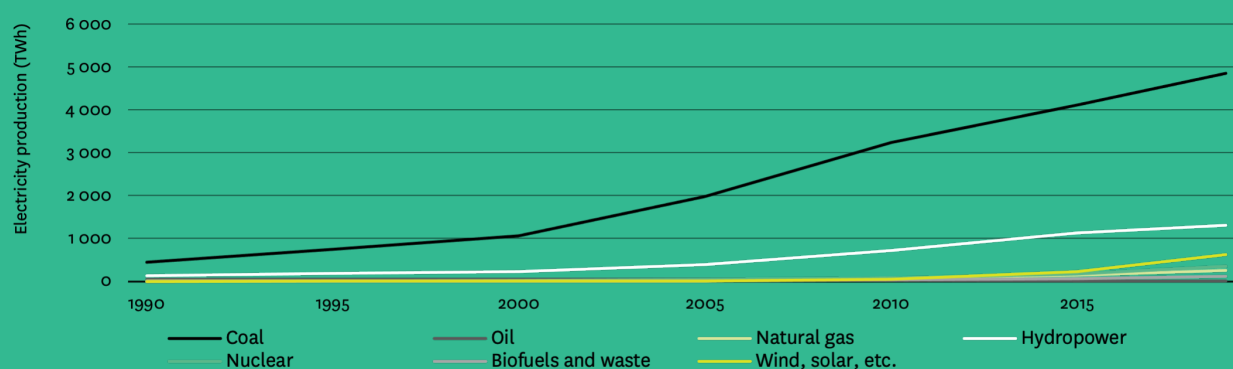
3. Historical change in primary energy production in China by source (1990-2019)²



Coal continues to dominate the country's total energy supply (Figure 3), which is the total energy resources for a country's domestic consumption of heat, electricity, and transport. For the past decade, coal has provided about 2 billion tons of oil equivalent, far ahead of petroleum.

The pattern is similar when focusing on electricity generation (Figure 4): coal still dominates China's electricity mix, and its growth seems to have barely slowed in recent years. Hydropower is the second largest source of electricity generation in China. Other sources of electricity account for a much smaller share.

4. Historical change in primary electricity production in China by source (1990-2019)²



5. Overview of low-carbon electricity production in China by source (1990-2019)²

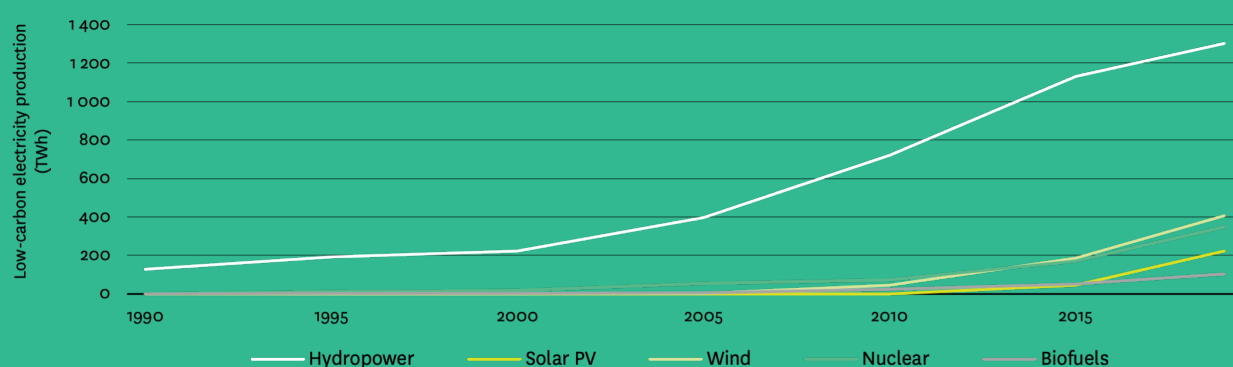


Figure 5 shows China's electricity production from low-carbon sources: hydropower, wind, nuclear, photovoltaic, biofuels, geothermal, and solar thermal.

The substantial development of wind power capacity since the early 2000s and photovoltaic capacity since the mid-2010s has led their contribution to the country's electricity production to increase significantly; however, both technologies still lag far behind hydropower.

2. Source: International Energy Agency.



Philip Andrews-Speed • Senior Principal
Fellow at the Energy Studies Institute, National University of Singapore

Governing China's Energy Sector to Achieve Carbon Neutrality

54

China accounts for nearly 30% of the world's carbon dioxide (CO₂) emissions from energy. The absolute quantity of emissions continued to rise at 2-3% per year during the decade to 2019¹, and is estimated to have grown by 0.8% during the Covid-19 pandemic year of 2020². This continuing increase of CO₂ emissions is caused by the ongoing growth of the economy which in turn has been driving annual energy consumption rises of more than 4%. Fossil fuels are still dominant. In 2019, they provided for 85% of the primary energy supply, with coal accounting for 57%. Coal consumption did decline between 2013 and 2016, but it then rose a total of 3% between 2016 and 2019³. Energy consumption continued to rise during the 2020 pandemic, with that for coal increasing by an estimated 0.6%⁴. Demand for coal is likely to rise sharply in 2021 as the economy continues to rebound from the pandemic⁵. Consumption of both oil and natural gas continued to increase in 2020 and demand for both fuels is set to accelerate in 2021⁶.

This, then, is the background against which China's government will be drawing up their short- and medium-term plans for achieving President Xi Jinping's pledge reach peak CO₂ emissions before 2030 and to strive for carbon neutrality by 2060. A drastic reduction of CO₂ emissions from the energy sector will be the most essential element, but not the only one. Other sources of emissions such as agriculture are also relevant, as are carbon sinks.

1. BP, *BP Statistical Review of World Energy 2020*, BP, 2020.

2. Climate Action Tracker, China.

3. BP, op. cit.

4. The Business Times, "China's Coal Consumption Share Falls to 56.8% at End-2020", March 2021.

5. International Energy Agency, "Annual Changes in Coal Consumption by Type and Use in China, 2019-2021".

6. S&P Platts, "Commodities 2021: China's Economic Comeback to Add Sparkle to Oil Demand", January 2021.

An increasing number of reports and papers are appearing that identify the specific challenges relating to the energy sector and the policy measures that should be implemented⁷. These include decarbonising electricity generation, electrifying end use sectors, switching to low-carbon fuels, sequestering CO₂ and making demand sustainable. Technologies to be deployed at an accelerated rate include renewable energy sources, energy storage of different types, ultra-high voltage transmission, electric vehicles, hydrogen, and 'smart' technologies to manage electricity supply and demand. Further, the government aims to enhance the role of market forces in the energy sector, including through the national emissions trading scheme.

As is to be expected, central government ministries, local governments and state-owned enterprises are currently (as of March 2021) busy working out how to respond to the carbon-neutral challenge. The proposed 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2030 was approved at the Fifth Plenum of the 19th CCP Central Committee in late October 2020 later by National People's Congress in March 2021⁸. The document addresses the need for emissions to peak before 2030 but does not mention the issue of carbon neutrality by 2060. The Five-Year Plans for Energy and for others sectors are likely to be published later in 2021 or in 2022. Although these five-year plans may not explicitly address the 2060 objective, it is likely that the government will also publish medium- and long-term plans for different sectors over the next two or three years.

It is quite likely that CO₂ emissions will peak by or before 2030, as long as the rate of economic growth remains relatively low. However, achieving carbon neutrality by 2060 is far more challenging and will provide a severe test to the way that China is governed. Whilst the Party-State has managed to enhance its control over the economy and society under the leadership of Xi Jinping, a number of questions remain in the context of the nation's low-carbon transition. These include the existence of competing policy priorities across sectors, competing interests of different actors, the perpetual challenge of policy coordination, the way in which the energy sector is governed, and the need for technological and institutional innovation.

The aim of this paper is to identify the factors that will assist China's transition to carbon neutrality and those that will constrain it by drawing on past experience in the energy sector. The next section shows how a combination of state and financial capacity has formed the basis of the country's success to date in constraining the rise of carbon emissions. This is followed by an examination of those factors that have distorted or delayed energy policy

7. For instance: The Energy Foundation, "China's New Growth Pathway: From the 14th Five-Year Plan to Carbon Neutrality", December 2020.

8. B. Hofman, "China's 14th Five-Year Plan: First Impressions", East Asia Institute, National University of Singapore, EAI Commentary 26, March 2021.

implementation, with a focus of coordination challenges.

Factors that may assist the transition to carbon neutrality

China's government is characterised by a formally centralised authority and strong state capacity. Together, these should assist the nation's low-carbon transition. However, the capacity of the Party-State to design and implement policy has varied with time. The 1980s saw a high degree of decentralisation as part of economic policy. By the early 1990's this decentralisation had resulted in a radical decline of the central government's budget. The fiscal reforms of 1994 reversed this trend⁹. However, progressive economic reforms carried out during the 1990s reduced the influence of central government over the economy. This led to excessive economic growth, pervasive corruption and extensive environmental damage¹⁰.

Under the leadership of President Xi Jinping, the central government has succeeded in increasing its control in many fields, including the economy. Economic growth has been allowed to slow to a "new normal", state-owned enterprises remain central to government strategy and these enterprises have been subject to stricter fiscal and personnel controls. Within the energy sector, the state remains deeply involved. The production, transmission and transformation of energy within China is dominated by enterprises that are wholly or partially owned by the state at central or local government levels. The same applies to the highly energy-intensive energy industries such as steel, chemicals, cement and plate glass. Enterprises that are wholly or majority privately owned do play a significant role in some niches within the energy sector, especially those relating to new technologies such as renewable energy, batteries and electric vehicles. However, even these companies are likely to have close links with their local governments which, in many cases, have a significant shareholding in the company.

Within the government, the capacity to oversee the energy sector has also been growing. After the abolition of the short-lived Ministry of Energy in 1993, there was no clearly identifiable agency responsible for energy policy and regulation. Instead, these roles lay within departments of the State Planning Commission, now named the National Development and Reform Commission (NDRC). The government reforms of 2003 saw the creation of the National Energy Bureau within the NDRC. In 2008, this bureau was upgraded to be the National Energy Administration (NEA), also within the NDRC. Two years later, in 2010, a National Energy Commission was created, under the chairmanship of the Prime Minister, to oversee policy

coordination across ministries¹¹. The NDRC and other ministries have equivalents at all levels of local government. The NEA has six regional bureaus and 12 provincial offices that allow it to monitor and direct local developments in the energy sector. A reorganisation in 2018 led to the Ministry of Environment Protection being renamed the Ministry of Ecology and Environment (Fig.1) and taking over from the NDRC responsibility for implementing the national carbon market.

These structures along with the state ownership of most large enterprises along the energy supply chain have given the central government significant capacity to implement new energy policies over a relatively short timescales. The key to success has been the combination of administrative policy instruments and generous funding. Three historic examples are the energy efficiency campaign of 2005 to 2010, the programme to boost the deployment of renewable energy starting in 2009, and the measures to reduce air pollution from the power industry introduced in 2013.

When Wen Jiabao became Prime Minister in 2003, many Chinese provinces were suffering from a severe shortage of electricity resulting in systemic power outages. This was a result of soaring economic growth in the absence of new power generating capacity. In response, the government launched an energy efficiency campaign that aimed to reduce national energy intensity by 20% between 2005 and 2010. This involved setting energy intensity targets for local governments and state owned enterprises. A key component was the Top 1,000 Enterprises programme that focused on the large energy-intensive industries. Electricity tariffs for such industries were also raised. The outcome of these and other measures was that national energy intensity declined by an estimated 19.1% over this period, not far short of the target¹².

The development of wind and solar power in China dates back to the 1980s and 1990s respectively. However, it was only in 2005 that the central government made this a priority, in part on account of the power shortages just mentioned. The 2005 Renewable Energy Law introduced the concept of mandatory market share for renewable energy to any generating company with more than 5 GW of total capacity. Four years later, the 2009 Renewable Energy Law introduced feed-in-tariffs for the first time. Over the same period, the central government had been increasing funding for renewable energy research and development, and local governments were providing generous support in many forms for the manufacturers of wind power and solar photovoltaic (PV) equipment¹³. The

9. C. Wong, "Rebuilding Government for the 21st Century : Can China Incrementally Reform the Public Sector ?", *The China Quarterly*, vol. 200, 2009.

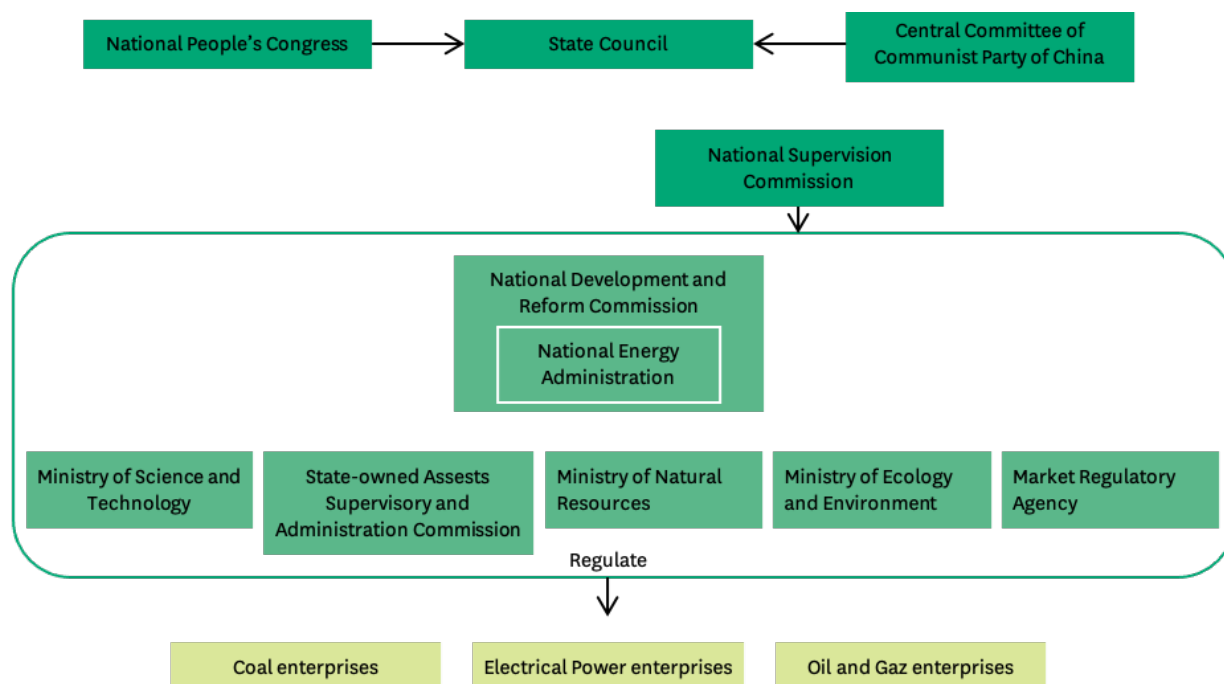
10. B. Naughton, "The Chinese Economy. Transitions and Growth, Cambridge, Massachusetts", MIT Press, 2007 ; E. Economy, "The River Runs Black. The Environmental Challenge to China's Future", Cornell University Press, 2004.

11. P. Andrews-Speed and S. Zhang, "China as Global Clean Energy Champion : Lifting the Veil", Springer Nature, 2019.

12. P. Andrews-Speed, "The Governance of Energy in China : Transition to a Low-Carbon Economy", Palgrave Macmillan, 2012.

13. S. Zhang, P. Andrews-Speed, X. Zhao et Y. He, "Interactions Between Renewable Energy Policy and Renewable Energy Industrial Policy : A Critical

FIGURE 1 • SIMPLIFIED SCHEME SHOWING THE MAIN ENERGY-RELATED ORGANISATIONS AND ENTERPRISES AT CENTRAL GOVERNMENT LEVEL AFTER MARCH 2018.



result was a surge in deployment of wind and solar PV infrastructure within China and growing exports of wind and solar power equipment¹⁴.

A further requirement for the success of this renewable energy was the development of direct current ultra-high voltage (DC UHV) transmission lines to carry the power from the remote northern and western regions of China to the demand centres in the centre and east of the country. Although the basic technology for UHV DC transmission had been developed in a number of countries, no commercial production of the equipment and no integrated UHV DC transmission system existed anywhere in the world at the beginning of the twenty-first century. It was the State Grid Corporation of China that was the first to commercialise the technology and to build an extensive network¹⁵.

Air pollution from the use of coal in industry, heating and power generation has been a serious health problem in China for decades. Economic growth has led to a steady increase in the intensity of air pollution in the form of nitrous oxides, sulphur dioxide and particulate matter. Numerous attempts to constrain this rise met with limited success until 2006 when the levy for sulphur dioxide emissions was raised to a level above that of the cost of mitigation. This was accompanied by the installation

Analysis of China's Policy Approach to Renewable Energies, Energy Policy, 2013.

14. S. Zhang et al, "Interactions Between Renewable Energy Policy", REN21, Renewables 2018 - Global Status Report, REN21, 2018.

15. Y.-C. Xu, Sinews of Power, "Politics of the State Grid Corporation of China", Oxford University Press, 2017.

of equipment to allow remote monitoring of emissions from all thermal power stations and the introduction of a subsidy to those plants using flue-gas desulphurisation equipment. These measures led to a decline in sulphur dioxide emissions. However, the economic stimulus that followed the global financial crisis of 2008 reversed this trend and by the winter of 2011/2012 the public outcry over the rising levels of air pollution threatened to undermine the legitimacy of the government. In 2013, an action plan of air pollution was issued. This was followed by other administrative and legal measures that together drove a sustained improvement of air quality, especially in the main cities¹⁶.

An example more relevant to the future is the government's policies for the development of battery technologies and electric vehicles. As was the case for renewable energy, support was directed along the full supply chain and involved both central and local governments.

Research into the technologies for new electric and hybrid vehicles began in the mid-1990s and from that time received progressively increasing support from government research and development funds. In response to the 2008 global financial crisis, twenty five cities were identified to push forward with electric vehicles. Subsidies from central and local government provided were directed at charging infrastructure and vehicle purchase, and covered both cars and city buses. By 2010 and 2011, the annual production of new energy vehicles had reached 7,000 and

16. D. Seligsohn and A. Hsu, "How China's 13th Five-Year Plan Addresses Energy and the Environment", ChinaFile, 10 March 2016.

the national fleet exceeded 20,000. Of these, 25% were battery electric vehicles, the rest were hybrids¹⁷.

The subsequent years saw central and local governments pursue an ambitious agenda for new energy vehicles, particularly for battery and plug-in hybrid electric vehicles. Quotas were set for manufacturers, subsidies were provided for vehicle purchase, and local governments preferentially licensed electric vehicles and, in some places, waived parking fees¹⁸. As a result, the annual sales of electric cars rose to 1.2 million in 2018. Sales remained at the same level in 2019 because the government had reduced the subsidies on vehicle purchase¹⁹. By mid-2020, annual sales of electric vehicles accounted for 4.4% of car sales²⁰. December 2019 saw the government announce that electric cars should make up 25% of car sales by 2025, up from the 20% target set for 2025 in 2017²¹. This share could rise to 50% by 2035²².

These and other examples show that China's Party-State has the capacity, backed by ample funding, to take bold steps to address policy challenges and to take advantage of policy opportunities. The examples of renewable energy and electric vehicles reveal two additional features. First, that funding for research and development can be started decades before the appearance of commercial opportunity and, second, that strong synergies can be developed between industrial and energy policies.

A key to these and other policy successes in China continues to be the authority of the Communist Party and its deep involvement of the Party at all levels of government and in state-owned enterprises. At the top are the Central Leading Groups (sometimes referred to as Leading Small Groups) that are key coordinating bodies that exist in both the Party and the government. The former are more powerful. This power has been enhanced under the leadership of Xi Jinping for, since May 2018, he has headed at least five Party Leading Groups, in addition to his roles as Party General Secretary, President of China, and Chair of the two Central Military Commissions and of the National Security Committee. The most important of these Party Leading Groups for the economy is the Central Leading Group for Comprehensively Deepening Reforms, which was renamed as a Central Leading Committee in 2018.

17. H. Gong, M.Q. Wang, et H. Wang, "New Energy Vehicles in China : Policies, Demonstration, and Progress", *Mitigation and Adaptation Strategies for Global Change*, 2013.

18. V. Krusmann, "Mobility in 21st century China : Snapshots, Dynamics, and Future Perspectives", *GIZ*, 2019.

19. T. Gersdorf et al., "McKinsey Electric Vehicle Index : Europe Cushions a Global Plunge in EV sales", *McKinsey*, July 2020.

20. T. Gersdorf, R. Hensley, P. Hertzke et P. Schaufus, "Electric Mobility Demand After the Crisis : Why an Auto Slowdown Won't Hurt EV Demand", *McKinsey*, September 2020.

21. Bloomberg News, "China Raises 2025 Electrified-Car Sales Target to About 25%", December 2019.

22. Reuters Staff, "China's NEV Sales to Account for 20% of New Car Sales by 2025, 50% by 2035", *Reuters*, October 2020.

The authority of the political leadership is transmitted downwards through three mechanisms: the nomenklatura system which controls staff appointments; the xitong system that allows the party to supervise activities across government agencies; and the dangzu groups that oversee the work of the Party Committees in all state-linked organisations²³. More recently, the Party has taken steps to increase its oversight not only of state-owned enterprises, but also of private companies²⁴.

Despite the strong influence of the Communist Party, the multi-level and decentralised governance structure has brought two major advantages to China's economic development. First, different localities have been able to pursue economic strategies that suit their conditions. Second, it has allowed the central government to carry out policy experiments in economic, administrative and political fields in a limited number of locations before deciding whether and how to roll out the policy across the country²⁵.

The growing awareness among citizens of the country's environmental challenges has resulted in a dramatic increase in the number of environmental non-governmental organisations (NGOs) in China. They have become increasingly active in drawing attention to policy failures, arguing the case for certain policy measures and requesting information. However, they are rarely involved in policy deliberation and their influence remains weak²⁶.

Cautious experimentation has underpinned much of China's economic success since the early 1980s. In the energy sector, this has involved the incremental liberalisation of producer and consumer tariffs for energy as well as the reform of state-owned energy enterprises. The steady corporatisation and commercialisation of these companies during the 1980s and 1990s was followed by a major restructuring in the period 1998-2002, accompanied by partial listing on domestic and foreign stock exchanges. However, these reforms did not succeed in introducing competition into the energy sector. Rather, the large centrally-owned, state-owned energy enterprises were able to increase their market power at the expense of private and local state-owned companies.

On his ascent to power, President Xi announced that he wanted to increase the role of market forces in the eco-

23. Y. Zheng, "The Chinese Communist Party as Organizational Emperor. Culture, Reproduction and Transformation", *Routledge*, 2010.

24. S. Livingston, "The Chinese Communist Party Targets the Private Sector", *Center for Strategic & International Studies*, 2020.

25. S. Heilmann, "Economic Governance : Authoritarian Upgrading and Innovative Potential", in J. Fewsmith (ed.), *China Today, China Tomorrow. Domestic Politics, Economy, and Society*, Rowman & Littlefield, 2010.

26. J.Y.J. Hsu et R. Hasmath, "Governing and Managing NGOs in China. An Introduction", in R. Hasmath et J.Y.J. Hsu (eds.) *NGO Governance and Management in China*, *Routledge*, 2016. G. Chen, *Politics of Renewable Energy in China*, *Edward Elgar*, 2019.

onomy. The energy sector has been affected in three ways. First, 2015 saw the revival of plans to introduce competition across the full supply chain of electrical power, from generation through distribution to retail²⁷. Second, in 2019, the oil and gas pipeline assets of the national oil companies were consolidated into a separate new company (PipeChina)²⁸. Finally, the government launched the national carbon emission trading scheme in January 2021 after several years of local pilot schemes²⁹. Whilst these market initiatives appear to promise improvements in economic efficiency and emission reduction, a range of institutional factors may constrain their effectiveness, as will be discussed in the next section.

Factors that may constrain the transition

The key challenge for China's central government in any field of policy is coordination. Although legally a unitary state, formal authority lies at three main levels of government: central, provincial or municipal, and city or county. This structure combined with multiple ministries, powerful state-owned enterprises and huge geographic scale results in a complex matrix of governance that led to the creation of the term 'fragmented authoritarianism'³⁰. Poor coordination is often the result. This may be caused by excessive haste in implementation that does not allow supply chains to react appropriately, or by excessive enforcement of new policies without due consideration for such issues as economic viability, technical standards or safety. In addition, local governments and state-owned enterprises retain the ability to ignore, undermine or distort central government policies to their own benefit. Such behaviours are often accompanied by false reporting, 'feigned compliance' and corruption, problems that date back to Imperial times³¹.

This section illustrates the challenge of policy coordination by drawing on historical examples, before assessing the likely success of newly introduced market mechanisms in improving coordination. It concludes by identifying potential coordination difficulties between different policy fields.

Historical examples of poor coordination

Impetuous decision making

Impetuous policy making by central government can

result in poor coordination in implementation and unintended consequences. A relatively recent example is the plan to convert the heating systems of up to four million households in northern China to natural gas or electricity in 2017 in order to reduce air pollution. At the same time, some 44,000 coal-fired boilers were to be scrapped and the sale of coal in the selected towns and villages banned. However, the construction of the necessary pipelines and storage tanks to support this dash for gas was an immense task with a cost of billions of RMB and could not be completed in the required time³².

Although meeting with considerable success, the impetuous nature of this short-term gasification plan produced three undesirable consequences. First, although natural gas is more convenient and cleaner for families, it is more expensive than coal. Northern China is home to large numbers of low income families and the high price of natural gas led many households to reduce their use of heating. To alleviate such hardship, the government provided a certain quantity of gas at subsidised prices. Second, many coal-fired heating systems that were decommissioned had not been replaced by gas-fired ones by the onset of winter, leaving households without any heating at all³³. Finally, the additional call on international markets for gas supplies had immediate effect on international markets, with Asian spot LNG prices reaching close to US\$ 11 per million British Thermal Units (mmBTU) in January 2018, up from a low of less than US\$6 per mmBTU in June 2017.

Local government resistance

Central government policy implementation often takes the form of vigorous campaigns, a style of governance in China that is not limited to the energy sector³⁴. One such campaign in the late 1990s and early 2000's was aimed at closing large numbers of small-scale township and village coal mines. During the 1980s and early 1990s these mines played a critical role in supplementing the output of large-scale, state-owned mines to ensure the nation's growing economy was well supplied with energy. By the mid-1990s, some 80,000-100,000 of these small-scale mines accounted for nearly 50% of the country's total coal production. But they were also the location of about 70% of the annual toll of coal mine 6,000 deaths in 1996³⁵. A campaign to close large numbers of these mines was launched in 1998 on the grounds of safety, resource conservation and oversupply. This policy directly hit local

27. Central Committee of the Communist Party of China and the State Council, "Opinions on Further Deepening the Reform of the Power System", document number 9, 2015.

28. Downs et S. Yan, "Reform is in the Pipelines : PipeChina and the Restructuring of China's Natural Gas Market", Columbia/SIPA, Center on Global Energy Policy, Commentary, 2020.

29. F. Jotzo et al, "China's Emissions Trading Takes Steps Towards Big Ambitions", Nature Climate Change, 2018.

30. K.G. Lieberthal et M. Oksenberg, "Policy Making in China. Leaders, Structures and Processes", Princeton University Press, 1988.

31. L.W. Pye, "The Spirit of Chinese Politics", Harvard University Press, 1992.

32. D. Sandalow, A. Losz, et S. Yang, "Natural gas giant awakens: China's Quest for Blue Skies Shapes Global Markets", Columbia/SIPA, Center on Global Energy Policy, Commentary, 2018.

33. M. Lelyveld, "China's Fuel Fiasco Leaves Citizens in the Cold", Radio Free Asia, December 26th 2017.

34. J.J. Kennedy, J. James et D. Chen, "State Capacity and Cadre Mobilization in China : The Elasticity of Policy Implementation", Journal of Contemporary China, 2018.

35. E. Thomson, *The Chinese Coal Industry : An Economic History*, Routledge-Curzon, 2003 ; P. Andrews-Speed, *Energy Policy and Regulation in the People's Republic of China*, Kluwer Law International, 2004.

economic interests. In response, many local governments systematically falsified their reports to higher authorities. Many mines that were reported as having been closed were either never closed or were closed and then quickly re-opened.

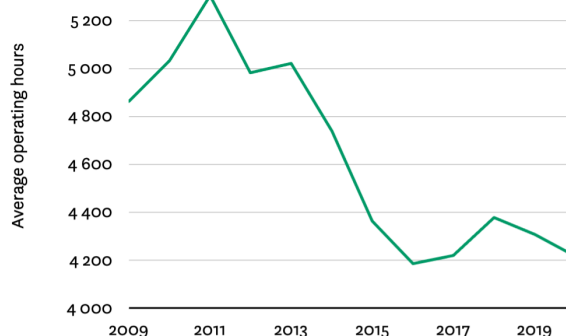
More recently, some local governments, often in collaboration with power companies, have taken active steps to protect or even promote coal-fired power generation in contravention of central government policy to increase the use of renewable energy. Such distortion of policy has taken two main forms. The first has involved favouring thermal power over renewable energy leading to substantial curtailment of wind and solar power. Average curtailment across the nation of wind energy rose from 8% in 2014 to 17% in 2016, with Gansu recording 40% that year³⁶. The curtailment of solar power in 2016 also reached a peak, of 10% in this case. By 2019, curtailment of wind and solar power had declined to 4% and 2% respectively³⁷.

The sources of this high level of curtailment were numerous and included a number of purely technical issues³⁸. However, the actions of local governments were also important. The number of hours of generation allocated to thermal plants was then still determined by local governments that created annual plans to be implemented by local system operators. Some local governments took advantage of this system to protect thermal power plants by dispatching thermal power in preference to renewable energy in direct contravention to the 2009 Renewable Energy Law as they employ more people and generate more local tax revenue than renewable energy installations³⁹. Also, the thermal power stations lose out if the local grid operator dispatches renewable energy preferentially, for a reduction of operating hours raises the breakeven price⁴⁰. Nevertheless, average annual operating hours for thermal power plants across China declined sharply after 2011 (Figure 2). 2016, annual averages have been consistently at or below 50%.

Local government support for coal-fired power has also been apparent in its encouragement for the construction of new generating plants in the absence of any obvious need in the form of an imminent supply-demand imbalance. In November 2014, the central government delegated the authority to approve the construction of new power plants to provincial governments. This led to

permits being issued to 210 coal-fired plants with a total capacity of 165 GW in 2015 alone, mainly in coal-rich provinces⁴¹. Very few of these projects were approved by the central government⁴². Although the central government took back control over project approvals in April 2016, some 95 GW of new capacity was still under construction at the end of 2017⁴³.

FIGURE 2 • AVERAGE ANNUAL OPERATING HOURS FOR CHINA'S THERMAL POWER PLANTS WITH CAPACITY > 6 MW



State-owned enterprise resistance

State-owned energy enterprises also have the power to obstruct or ignore central government policies, and the national oil companies have been guilty of this on more than one occasion. Fuel quality is closely related to vehicle emissions, for the technology within the vehicle to reduce emissions relies on the concentration of pollutants in the fuel being below a certain level. Beijing banned the sale of leaded gasoline in 1997 and since then the central government has steadily raised the required standards of gasoline and diesel, especially for sulphur content. However, the actual quality of fuels sold has generally lagged behind the implementation of new standards, sometimes by several years. The main source of this weakness has been the reluctance of the national oil companies to upgrade their facilities. This has resulted not just in slow implementation but also in a high degree of variability across the country⁴⁴.

The legal system

It might be imagined that the legal system would form a route to address these abuses and distortions. However, despite reforms the overall approach to the law continues

36. A. Hove, "Current Direction for Renewable Energy in China", Oxford Institute for Energy Studies, Commentaire, June 2020.

37. Annual data for wind and solar power curtailment in recent years is published on the website of the National Energy Administration.

38. Z.-Y. Zhao, R.-D. Chang, et Y.-L. Chen, "What Hinder the Further Development of Wind Power in China ? - A Socio-Technical Barrier Study", Energy Policy, 2016.

39. Z.-Y. Zhao, S. Zhang, Y. Zou, et J. Yao. "To What Extent Does Wind Power Deployment Affect Vested Interests ? A Case Study of the Northeast China Grid", Energy Policy, 2013.

40. M.R. Davidson et al., "Modelling the Potential for Wind Energy Integration on China's Coal-Heavy Electricity Grid", Nature Energy, 2016.

41. L. Myllyvirta et X. Shen, "Burning Money. How China Could Squander Over One Trillion Yuan on Unneeded Coal-Fired Capacity", Greenpeace, 2016.

42. M. Ren et al., "Why has China Overinvested in Coal Power ?", The Energy Journal, 2021.

43. C. Shearer et al., "Boom and Bust 2018. Tracking the Global Coal Plant Pipeline", Coalswarm/Sierra Club/Greenpeace, March 2018.

44. Y. Wu et al., "On-Road Vehicle Emissions and Their Control in China : A Review and Outlook", Science of the Total Environment, 2017. ; J. Wang et al., "Vehicle Emission and Atmospheric Pollution in China: Problems, Progress, and Prospects", PeerJ, 16 May 2019.

to bear a striking resemblance to that of Imperial times. The law is still seen as an instrument of government and the Party, to be deployed to retain power, maintain social order and promote economic development⁴⁵.

One innovation that should have supported the implementation of clean energy policies was a revision to the Environmental Protection Law that came into effect in January 2015 and for the first time permitted officially registered environmental NGOs to file public interest claims in the People's Courts⁴⁶. However, NGOs face a number of obstacles in filing cases in court. In addition to the requirement to be officially registered with the government, most Chinese environmental NGOs lack the funds and the expertise, face difficulties obtaining the necessary evidence, and encounter overly restrictive rules of standing. Moreover, they have no right to bring cases against public authorities. Only the procuratorates can do so. This is important because most violations have their roots in the failure of local governments to fulfil their obligations. Furthermore, Chinese law does not allow private parties to use the law to prevent other private parties causing damage before the damaging action takes place⁴⁷.

In 2016, the prominent environmental NGO, the Friends of Nature, filed cases against the grid companies of Gansu and Ningxia on the grounds that they had failed to purchase all the available wind and solar energy in their respective areas of jurisdiction. The claims were based on the environmental damage caused by the companies' actions. Progress in the courts has been very slow and as of March 2021 neither case seems to be been resolved⁴⁸.

Likewise, as of 2018, no cases had been brought by either the NEA or renewable energy companies against the grid companies for failures to purchase renewable energy. The lack of action by the NEA relates to a range of technical and system management issues as well as the tension between these requirements and longstanding local practises. The Ministry of Ecology and Environment publically criticised the NEA and their local offices in January 2021 for failing to adequately implement a wide range of environmental policies⁴⁹. In the case of the renewable energy companies, they face a large power differential between them and the vast monopoly that is the grid company⁵⁰.

45. C. Wang et N.H. Madson, *Inside China's Legal System*, Chandos Publishing, 2013.

46. R.Q. Zhang, et B. Meyer, "Public Interest Environmental Litigation in China", *Chinese Journal of Environmental Law*, 2017.

47. P. A. Barresi, "The role of law and the rule of law in China's quest to build an ecological civilization", *Chinese Journal of Environmental Law*, 2017.

48. X. Wang, "Serious Wind and Solar Curtailment : Environment Protection Organization v. State Grid Gansu will Enter Trial", January 2019 (in Chinese).

49. Ministry of Ecology and Environment, "The Sixth Central Ecological and Environmental Protection Supervision Group Feedbacks the Inspection Situation to the National Energy Administration", January 2021 (en Chinese).

50. H. Zhang, "Prioritizing Access of Renewable Energy to the Grid in China : Regulatory Mechanisms and Challenges for Implementation" *Chinese Journal of Environmental Law*, 2019.

Over-enthusiasm of local governments

Local governments are not always obstructive. Indeed, they can be over-enthusiastic in their implementation of central government policy, especially if it benefits economic activity within their jurisdictions. This has been evident in the manufacturing of equipment for wind and solar energy. The Renewable Energy Laws of 2005 and 2009 triggered a surge in deployment of wind and solar PV installations across China as well as in equipment exports. The central government and state-owned banks provided a range of supportive measures to equipment manufacturers through grants for research and development, low-cost loans, tax rebates and export credits. Local governments supplement these incentives by providing access to land and electricity supplies at subsidised prices⁵¹.

This success in building a world leading renewable energy manufacturing industry was not achieved without cost. In addition to the substantial financial support described above, the rapid growth of the wind and solar PV manufacturing industries led to massive overcapacity in both cases. By 2011, 40% of the country's wind power equipment manufacturing capacity was idle⁵². In 2012, it was reported that more than 2,000 enterprises in over 300 cities were developing solar PV manufacturing capacity. Capacity for producing PV panels had reached 20 times the national demand and twice that of global demand⁵³. This excess of capacity arose from the over-enthusiastic support from local governments. Data from the U.S. investment agency, Maxim Group, showed that China's top ten photovoltaic makers had accumulated a combined debt of 111 billion RMB by August 2012 leading the whole industry to the brink of bankruptcy⁵⁴. This led to a period of industrial consolidation. The demand for higher standards of equipment is currently causing a second phase of consolidation among PV manufacturers, with the smaller players losing out⁵⁵.

Introducing market forces

To address these and other governance challenges, the government has been reinvigorating measures to enhance the role of market forces in the energy sector. The aims include aligning energy prices with market forces, improving the commercial performance of the state-owned energy companies and, in the case of oil and gas, boost-

51. P. Andrews-Speed et S. Zhang, "Renewable Energy Finance in China", dans C.W. Donovan (ed.), *Renewable Energy Finance*, Imperial College Press, 2015.

52. J. Li, et al. "China Wind Power Outlook 2012", Greenpeace, 2012 (in Chinese).

53. D. Collins, "China's Photovoltaic Industry on Brink of Bankruptcy", August 2012.

54. "China's PV Industry is on the Verge of Bankruptcy", Qianzhan, September 2012.

55. M.Hall, "Chinese Polysilicon Makers Driving Industry's Second Great Consolidation", *PV Magazine*, October 2020.

ting the production of domestic resources⁵⁶. These efforts date back to the 1990s. The slow progress since then can be attributed to the influence of the state-owned energy companies on the policy-making process, natural caution of the part of leadership, and the ability of local governments and energy companies to undermine or distort the roll out of new market measures. The two most prominent initiatives are the introduction of competition to the electricity industry and the launch of a national carbon trading scheme.

Electricity market reform

The reforms to the electricity industry announced in 2015 proposed a number of measures: the promotion of competition in power generation by allowing generating companies to negotiate directly with large customers; the introduction of pilot spot markets; a system for setting and regulating transmission and distribution tariffs; opening investment in and operation of new distribution networks to companies other than the two existing grid enterprises; and the introduction of competition in electricity retail.

Whilst it is still early days in the reform process, a number of challenges have already appeared that reflect historical development China's energy sector. Local governments have been interfering with the market in different ways. They have been intervening in the bilateral transactions between generators and industrial consumers and not applying the agreed transmission and distribution tariffs⁵⁷. Local governments continue to undermine the key objective of enhancing inter-regional power trading, not least to reduce the curtailment of renewable energy⁵⁸. Local agencies have also been distorting tenders for new distribution projects⁵⁹ as well as providing subsidies to loss-making power generators⁶⁰.

Further, the grid companies are able to use their strong market position to distort any emerging competition in distribution and retail. They have been demanding a controlling share of new distribution projects as a condition of providing access to the transmission in-

frastructure⁶¹. Likewise, the grid companies have set up nominally independent power retailers that draw on staff and information from the parent company, thus undermining fair competition with new entrants⁶².

Carbon emissions trading scheme

In order to accelerate the decarbonisation of the energy sector, the country launched a national carbon emissions trading scheme in February 2021. Back in 2013, a number of pilot carbon emissions trading markets were initiated in different locations around the country⁶³. The pilot carbon markets varied in design, but most suffered from several deficiencies: over allocation of allowances leading to low carbon prices, low market liquidity, weak institutional infrastructure, and inadequate monitoring, reporting and verification⁶⁴. Of greater policy importance is the impact of the markets on carbon emissions. One study concluded that whilst the carbon emissions did decline in those industrial sub-sectors covered by the pilot schemes, this was due to a reduction of output rather than a reduction in emissions intensity⁶⁵.

In December 2017, the NDRC announced the long-awaited nationwide emissions trading scheme that would be implemented in phases. Initially, the national carbon market will cover only the power sector, including combined heat and power as well as the captive power plants of other industries. It will involve all units with annual emissions in excess of 26,000 tonnes of CO₂ or energy consumption greater than 10,000 tonnes of coal equivalent. The power sector was chosen to be first as it has reasonably good data, relatively few points of emission, and is the largest producer of CO₂ emissions in China.

As with other policy mechanism, issues relating to coordination and integrity are likely to characterise the national carbon market. For example, as provincial governments have responsibility for monitoring, verification and compliance, including for the accreditation of third-party verifiers, there is a risk that standards will vary across the country⁶⁶. Such variability may be further

56. Central Committee of the Communist Party of China and the State Council, "Opinions on Further Deepening the Reform of the Power System", Document Number 9, March 25th 2015 (in Chinese); 'The Central Committee of the Communist Party of China and the State Council issued the "Several Opinions on Deepening the Reform of the Oil and Gas System"', Xinhua News Agency, May 21st 2017.
57. C. Lin, "The Problem of Immature Market Trading Mechanism and Gaming of Local Interests Still Exist in the Four Years of 'Electricity Reform'", Sina, March 2019.
58. P. Wang, "Opportunities and Challenges in the Construction of Power Spot Market", China Power Enterprise, 2019, (en chinois); L. Ma, "Analysis of the Development of the Power Industry and Prospects for the Reform of the Power System", Polaris Transmission and Distribution Network, August 2019.
59. P. Fan, R. Li, et P. Han, "What is the Solution to the Problem of Incremental Distribution Reform?", China Energy News, January 2019 (in Chinese).
60. Interview with a scholar in Beijing, October 2019.

61. Y. Miao, Y. Liu, Z. Cao et M. Li, "Analysis on the Major Contradictions in the Reform of Incremental Distribution Network Business", Journal of Shanghai University of Electric Power, June 2019, (in Chinese).
62. South China Energy Regulation Office of National Energy Administration, "Report on Comprehensive Coordinated Supervision in 2018", December 2018 (in Chinese).
63. M. Duan et Z. Li, "Key Issues in Designing China's National Carbon Emissions Trading System", Economics of Energy and Environmental Policy, 2017.
64. L. Xiong et al. "The Allowance Mechanism of China's Carbon Trading Pilots: A Comparative Analysis with Schemes in EU and California", Applied Energy, 2017; M. Duan, Z. Tian, Z. Zhao, et M. Li, "Interactions and Coordination between Carbon Emissions Trading and Other Direct Carbon Mitigation Policies in China", Energy Research and Social Science, 2017.
65. H. Zhang, M. Duan, et Z. Deng, "Have China's Pilot Emissions Trading Schemes Promoted Carbon Emission Reductions? - The Evidence from Industrial Sub-Sectors at the Provincial Level", Journal of Cleaner Production, 2019.
66. L.H. Goulder, R.D. Morgenstein, C. Munnings et J. Schreifels, "China's National Carbon Dioxide Emission Trading System: An Introduction" Economics of Energy and Environmental Policy, 2017.

enhanced as these local agencies have to pay the cost of verification. Also, emissions trading schemes do not operate in isolation and are affected by many other policies. A key challenge in China will be to achieve effective coordination between the national carbon trading market and policies for energy efficiency and renewable energy. The success of the national ETS is also highly dependent on how the electricity market reforms progress⁶⁷. Without power sector reform, the national ETS is unlikely to reduce emissions in a cost-effective way⁶⁸. Effective coordination between these two initiatives and with other policy instruments has been made more difficult by the allocation of responsibility for the national carbon market to the Ministry of Ecology and Environment, whilst the NDRC retains leadership for the power industry reforms.

With both of these new market mechanisms, electricity and emissions, there is a significant risk that trading may well expand but the effects on industry efficiency and emissions reduction may be drastically reduced by insufficient coordination and distorting behaviours. As discussed above, the legal system does not provide much scope for private actors to challenge the decisions and actions of local governments or large state-owned enterprises.

Coordination between different policies

The carbon neutrality pledge requires the rate of economic growth to remain relatively low - Xi Jinping's "new normal". However, the economic recovery plan implemented in response to the Covid-19 pandemic has triggered a surge of infrastructure development. This in turn caused coal consumption in 2020 to rise to levels above that of 2019, although the share of coal in the primary energy mix did decline⁶⁹.

This illustrates that the challenge for China's leadership remains to keep economic growth high enough to maintain employment and social stability, but at the same time move from high-speed growth to high-quality growth by raising domestic consumption and reining in energy-intensive industries. However, the pace and energy-intensive nature of the economic recovery from Covid-19⁷⁰ combined with Xi's proposal that GDP should double by 2035⁷¹ will make it difficult for the planners to reconcile these trends with the low-carbon pledges, at least in the

short-term the aim of peaking carbon emissions by 2030.

Within energy agenda, a number of priorities expressed by the leadership in 2020 create potential tensions with priorities in other sectors. The government has repeatedly stated that the domestic production of energy of all types should increase and that dependence on oil and gas imports should decline⁷². This introduces two particular challenges. The first relates to industrial policy. The leadership has been encouraging state-owned enterprises of all types to become more commercially-oriented and has floated the possibility of creating a holding company like Singapore's Temasek Holdings that would more clearly separate the government from the SOEs and a reduction of their non-commercial obligations⁷³. However, most of China's remaining oil and gas reserves are likely to be of marginal commercial value, at best. These are not attractive targets for national oil companies that are supposed to shed their non-commercial obligations. Further, given the current leadership's preferential support for the state-owned industries, it is far from clear that the energy markets will achieve their potential economic benefits, as discussed in the previous section.

The desire to constrain oil imports also conflicts with environmental policy. As road transport undergoes electrification, the future source of demand growth for oil will be from petrochemicals. As a result, Chinese companies are accelerating their construction of facilities to transform coal into chemicals. By 2018, coal was the source material for 16% of China's petrochemicals, up from 3% in 2010⁷⁴. These processes require large amounts of water and emit high levels of greenhouse gases⁷⁵. To ameliorate the environmental impacts, companies will have to invest heavily in water recycling and carbon capture. Not only will this undermine the commerciality of the projects, but they will also require more energy, most probably in the form of coal.

Conclusion

President Xi Jinping's pledge to strive for carbon neutrality by 2060 caught most observers by surprise. Modelling by Chinese and other analysts have shown that whilst this is technically possible, it will require radical changes across the whole economy, not just the energy sector. The recent record of achievements relating to energy efficiency and clean energy have shown that China can beat expectations when it comes to fulfilling ambitious tasks. The key to these successes lay in the combination of administrative instruments and generous financing

67. F. Jotzo et al, "China's Emissions Trading Takes Steps Towards Big Ambitions", Nature Climate Change Commentary, 2018.

68. F. Teng, F. Jotzo et X. Wang, "Interactions between Market Reform and a Carbon Price in China's Power Sector", Economics of Energy and Environmental Policy, 2017. ; M. Dupuy, "The Quiet Power Market Transformation Behind the New Carbon Market in China", Energy Post, janvier 2018.

69. Business Times, "China's Coal Consumption Share Falls to 56.8% at End-2020", March 2021.

70. C. Shepherd et T. Hale, "China's Economic Recovery Jeopardises Xi's Climate Pledge", Financial Times, November 2020.

71. M. Pettis, "Xi's Aim to Double China's Economy is Fantasy", Financial Times, November 2020.

72. Xinhua Press Agency, "Full text : Energy in China's New Era", December 2020.

73. "The State Council Has Approved the Temasek-Style Form of Chinese State-Owned Enterprises", Caifu Hao, October 2020 (in Chinese).

74. C. O'Reilly, "CTO and MTO Projects in China May Decelerate", Hydrocarbon Engineering, May 2019.

75. R. Liu, Z. Yang, et X. Qian, "China's Risky Gamble on Coal Conversion", China Environment Forum, January 2020.

deployed by the government to a sector dominated by state-owned enterprises. Nevertheless, policy coordination has continued to be a problem mainly due to the divergent interests of key actors. As a result, costs have been high, not all objectives have been met and unintended consequences have been numerous. Further, the current approach to governing the energy sector seems to be reaching the limits of its effectiveness⁷⁶.

Recognising this, the current leadership is pressing ahead by enhancing the role of market forces in the energy sector. In the absence of robust market regulation, local governments and state-owned enterprises are likely to retain the ability to distort these markets, at least to some degree. This will constrain the economic benefits to be gained from the energy markets as well as the environmental benefits from the carbon market.

The wider challenge facing the government is to balance the tensions between different policy priorities in a way that is supportive of the carbon neutrality pledge. The most profound of these tensions is between the need for economic growth to support employment and the rising living standards of a vast population and the requirement to keep economic growth relatively low and transition to a highly innovative, technologically-based economy. This challenge will be accentuated by the decline of the working age population⁷⁷ and the low level of education being received by the 70% of children that have rural residence permits⁷⁸.

76. B. Lin, "China is a Renewable Energy Champion. But It's Time for a New Approach", World Economic Forum, Agenda, May 22nd 2018.

77. J.S. Black et A.J. Morrison, "Can China Avoid a Growth Crisis?", Harvard Business Review, September-October 2019.

78. S. Rozelle et N. Hell, *Invisible China. How the Urban-Rural Divide Threatens China's Rise*, University of Chicago Press, 2020.



Jean-François Di Meglio • President of Asia Center, Paris

Energy Security in China and “Virtuous Climate Diplomacy”: The Great Paradox

64

The Middle Kingdom no doubt does not bear this name – an exact translation of the characters 中国 – because its inhabitants understood early on that they were “in the middle of the world”. This misleading name perhaps comes from a sentiment formed very early on that the Chinese territory was naturally subject to isolation, which offered protection but also was a source of various kinds of dependence. It was under the Western Zhou dynasty at the beginning of the 8th century B.C. that the name “Middle Kingdom” first appeared¹, a term which was then borrowed by several western writers². The Chinese coastline is not truly a gateway, for it does not lead to “open” waters. In order to open up China through sea routes, straights must be crossed. On land, the presence of “barbarians” surrounding the Chinese territory often led Chinese leaders to be self-sufficient and protective. But this security, which until the mid-20th century was often hard-won, has been put to the test by the developments of the past 40 years and the issue of energy security has naturally arisen, an issue which was raised relatively soon after the birth of the People’s Republic following the launch of the Four Modernizations under Deng Xiaoping in November 1978, during the Third Plenary Session of the Communist Party’s Eleventh Congress³.

At one time self-sufficient in hydrocarbons, at a time when its GDP per capita was less than 200 dollars, China has been confronted with the need to develop its supply chain strategies since 1993⁴. After beginning to import in

1993, China has had to import crude oil and refined products since 1996 as its needs have grown. Since then, its dependence has only increased.

At 101,598 billion yuan (about 15,660 billion dollars), China now has the world’s second largest GDP in absolute value. However, per capita income barely exceeds 10,000 dollars⁵. This has implications for its energy needs, with average growth still sitting above 5% for at least the next few years as laid out in the Fourteenth Five-Year Plan (2021-2025) adopted by the National People’s Congress in March. Since the 1990s, energy efficiency has been improving, even if it is not yet to the level of larger, more developed countries⁶. According to the International Energy Agency, the energy/GDP ratio (tonne of oil equivalent/GDP) went from 0.9 in 1990 to 0.2 in 2019. This is in comparison to the United Kingdom at 0.12 and 0.05, respectively.

The issue of energy security can therefore be considered as a guiding principle for China’s strategic thinking and geopolitical vision in the 21st century. It is, in effect, an issue which challenges the traditional conceptions of a restrained China, whose ambitions were beginning to bring its shortcomings to light, in order to bring about the concept of a “proactive” China in terms of energy security policy.

Without a doubt, the very idea of the New Silk Roads – inventing a reverse dynamic from the one which prevailed at the time of the “invention” of the “west-east” routes of antiquity – would have never emerged without this awareness that the Chinese territory was not only limited by its perceived isolation, but also had “boundaries” that needed to be overcome.

Observing recent changes in the “Chinese line” regarding domestic, regional, and international policy, we can see shifts and splits which can be explained by regime and leadership changes. But these changes and shifts are not solely based on new ways of thinking or political ambitions; they also reflect internal political games. It is true that Xi Jinping has brought about a new understanding of China’s international role and increased the visibility of his country’s ambitions. However, apart from the overall strategy that has been pursued since its adoption at the 18th Party Congress in 2012, there have been gradual or drastic transformations in the way energy issues are resolved. These transformations are probably as much due to the changing pressures on the country and the changes in its energy partners – not only suppliers, but also those with whom China undertakes global concerns about resources to develop or protect together – as to changes in the direction of domestic policy. This article therefore

1. See the work of O.Venture, research director at the École Pratique des Hautes Études.

2. E. Maisonneuve, “La Chine au milieu du monde”, Agir magazine, 2011

3. The Four Modernizations, designed to establish China’s economic power and independence, focused on agriculture, industry, science and technology, and defense. These reforms aimed to open China to the foreign market and to close the industrial gap that had opened up since the beginning of the Cultural Revolution.

4. See A. Payette and G. Mascotto, Monde chinois, Spring 2010

5. “GDP per capita (current US\$) - China”, the World Bank data. Accessed on 30 May 2021

6. “Country profiles: China, United Kingdom”, International Energy Agency (accessed on 31 May 2021).

proposes a historical rereading of the Chinese perception and reality in terms of energy security. A comprehensive analysis by energy source of the questions and answers that China has faced and identified is presented first, followed by some new perspectives. The challenges faced are domestic, but naturally also global, for anything that affects China quickly becomes a global issue. Conversely, any significant challenge in the modern world is also felt in a China which, nolens volens, has no other choice but to continue with its “globalization”.

The obsession with perceived energy insecurity in the 1990s

The People’s Republic of China functions in a centralized and planned way. The existence of a Ministry of Energy which coordinates needs, strategies, prices, and appoints operators is, in such a context, the most logical expression of State intervention. Since the Planning Commission (NDRC in China) sets the five-year growth targets from the top, it is important to coordinate the impacts of these energy targets. However, the Ministry of Energy disappeared in China in 1993, only five years after its creation leaving a number of different entities with sometimes similar or overlapping roles. This is a direct reflection of the inconclusive struggles for influence within the energy field in China and could be seen as a sign of less State influence over energy issues. It could also be compared to India’s situation, where five ministers contribute to energy policy with each being responsible for a different energy source in addition to the different bodies responsible for distribution and price. But in China, this institutional cohabitation reveals more about the ability of opposing forces to coexist, sometimes in an effort to make the most of concealed competition, in order to bring about the best policy choices.

While the situation with the Ministry of Energy was very characteristic of a planned economy, the situation which followed not only had a profound effect on the mindsets of Chinese leaders at the highest levels of the State and Party, but also on the regime’s evolution concerning the hold that the “oil lobby” had gained over the system. Two symbolic elements characterize this period in which oil played a predominant role in China’s energy security strategy. First was the abortive attempt by China National Offshore Oil Corporation (CNOOC), China’s third largest state-owned oil company, to take control of the American company UNOCAL. In the summer of 2005, executives of the California-based oil company UNOCAL (the seventh largest in the U.S.) said they were considering the Chinese firm’s proposal to take over their company for a total of \$18.5 billion⁷. The announcement created great surprise in the United States and made American politicians aware of China’s growing economic strength. The

move, which countered competing American proposals, was naturally reviewed and then halted by the American authorities which oversee foreign investments. This initiative should be viewed against the backdrop of China’s joining the World Trade Organization (WTO) in 2001, only four years earlier. Through one of its oil companies, China launched a capital operation by outbidding the American oil company Chevron. Only the threat of a veto by the U.S. Senate was able to halt this bold move. China’s commercial “aggressiveness” in the oil sector indicates the importance the Chinese State places on this energy source for its overall energy security, as oil ranks second in the country’s energy mix.

Xi Jinping has expanded the notion of energy security

Following a period of very high visibility for China among governments and markets, Xi Jinping’s first years in power signaled the beginning of a new chapter characterized by sweeping reorganization of energy governance, of which the arrest of politician Zhou Yongkang on corruption charges in 2014 was one of the most significant events.

In the second half of 2014, two years after Xi Jinping’s rise to power, Zhou was accused of corruption and was stripped of all his political positions. He had most notably been General Director of the state-owned oil company China National Petroleum Company (CNPC), head of the Ministry of Land and Resources, and chief of national security, among other positions. He was arrested and expelled from the CCP and put on trial. Zhou was sentenced to life imprisonment for corruption, particularly for his links to the Chinese oil industry.

This incident is not simply part of the anti-corruption plan put in place by Xi Jinping when he came to power. It is also a sign that this fight against corruption has gone hand in hand with a re-evaluation of the counter-powers and strategies developed outside the central power.

Since the 2010s, the Chinese and international energy situation has been evolving in such a way that concerns other than securing oil supplies and the feelings of energy insecurity have increasingly come to the forefront of the country’s energy policy. In this respect, the growing interest in natural gas, energy efficiency, and the development of renewable energies illustrate the policy shift from a strictly security-based approach to a more complex, diplomatic one. This shift is all the more significant as it is taking place within the context of the COP 21 and the signing of the Paris Agreement as well as China’s recent, proactive rhetoric on the fight against climate change.

7. E. Leser, “L’offre de rachat du chinois Cnooc sur le pétrolier Unocal crée un débat aux États-Unis”, *Le Monde*, June 2005

From a quantitative to a qualitative energy security

If the years 2000 to 2015 were marked by China's exponential appetite for energy resources and the implementation of political and economic strategies to quantitatively combat a perceived form of energy insecurity, the years from 2015 onwards mark the beginning of a qualitative period of securing energy supplies. China is no longer simply ensuring quantity but securing safe and diverse routes.

Without denying the importance of Venezuelan oil – which supplied China with around 200,000 barrels of oil per day in 2020⁸ – or of Middle Eastern oil which depends on the Straits of Hormuz and Malacca, the Chinese government has worked to diversify supply routes. This has been the case with the New Silk Roads and the plan to transport oil through the Pakistani and Burmese pipelines in order to at least partially overcome the “Malacca dilemma”⁹. Similarly, the signing of a contract with Russia for the purchase of Siberian gas, partly paid for in Chinese currency¹⁰, as well as the growing power of Chinese players in Turkmenistan and Kazakhstan, illustrate this qualitative research.

This goes hand in hand with a change in China's energy mix¹¹, and thus allows for a doubly virtuous redefinition of Chinese strategic thinking on energy. On the one hand, alternative supply routes that compete less with other major consumers such as Japan and Korea – who remain highly dependent on Malacca and Hormuz – slightly alleviate the pressure on traditional concerns of strategic insecurity. On the other hand, the increasing use of alternative resources is helping to reduce China's carbon footprint at equivalent GDP growth rates.

One example of this approach's effectiveness can be seen in China's management of the diplomatic crisis with Australia. As China's second-largest foreign supplier of coal, which accounts for one-third of total imports¹², Australia has simultaneously sought closer ties with China since the 1990s and established regular supplies of coal. The diplomatic crisis between the two states, preceded by Australia's banning of Huawei from its 5G infrastructure deployment contracts, was revived in 2020 after the Australian Prime Minister demanded an official investigation into the origin of the coronavirus and threatened China with economic retaliation if it refused. Since Octo-

ber 2020, China has been informally boycotting Australian coal. Global commodity markets have been affected by this decision as China has turned to other suppliers such as Indonesia, Mongolia, and Russia. But the flexible management of coal supply contracts in a highly globalized market characterized by the predominance of “spot” contracts has meant that China's diplomatic actions have not been contingent on what might have been seen as insurmountable dependence.

China's energy flexibility

The question now is what does China's new energy landscape look like? It is one in which China has the influence and potential for flexibility that puts it in a prime position when it comes to global energy supply. This flexibility relies on understanding the different tools available such as diversification of energy sources and an increase in the number of international partners. China is even considering abolishing one of the most striking symbols of the previous era: the monopoly on crude oil imports previously reserved for the large state-owned oil companies.

In terms of natural gas, this adaptation is also reflected in the construction of numerous gas terminals which require major investments and the mastery of sophisticated technology. This adaptation can also be illustrated by the fading obsession with “coal liquefaction”. Typical of countries at risk of collapse – such as Germany in the 1930s or South Africa during the apartheid era – this costly and polluting process seemed to illustrate China's concern that it would find itself in a position of falling back on its own resources and running out of hydrocarbons. Both the difficulty of carrying out this project, piloted by the large state-owned coal company Shenhua, along with the decreasing relevance of such a system, led to its gradual suspension.

What chance of success for China's energy security policy?

China's energy policy is perfectly in line with its changing role in the regional and global geopolitical game. Forced to behave aggressively to the detriment of its image – until the strategic reversals brought about by the Xi era – China nevertheless continues to go it alone, regardless of its ability to assert its voice and views. In the Asia Pacific region, China is certainly one of the countries that has deliberately given the most lip service to multilateral dialogues on energy, climate, and the environment, making climate commitments that are surprising in light of the “security” strategy that dominated previous decades.

However, many ambiguities remain regarding its capacity to become a benevolent power. For the West, it is not a matter of asking its Chinese counterparts to aban-

8. “China's crude oil imports surpassed 10 million barrels per day in 2019”, US Energy Information Administration, March 2020
9. “Birmanie : un gazoduc qui renforce la stratégie d'approvisionnement énergétique chinoise en Asie du Sud-Est”, Monde chinois, 2013
10. B. Spegele, W. Ma, G. L. White, “Russia and China Agree on Long-Sought Natural Gas Supply Contract”, Wall Street Journal, May 2014.
11. [ndlr] See in the issue “Infography · Preface: Chinese Statistics” page 6.
12. “China Is Said to Mull More US Coal Imports to Cut Deficit”, Bloomberg Quint, 29 May 2018

don their domestic priorities in favor of a philanthropic diplomacy that would accommodate the global demands of preserving natural and energy resources with the demands of Chinese economic growth. Yet we can still expect greater transparency and a more palatable and sincere rhetoric on China's own energy strategy as we

measure how far it has come from the days of self-centered "security everything". Given the significant role that fossil fuels still play in its energy strategy, China is still far from being able to ensure the viability of its climate commitments through the implementation of its energy security policy.



Michal Meidan • Director of the China Energy Programme at the Oxford Institute for Energy Studies

Is China's Oil Sector Oblivious to the Country's 2060 Pledge?

68

China's oil demand has grown rapidly over the past three decades, as the country's economic activity, industrial development and urbanisation levels have generated a seemingly insatiable appetite for oil. Indeed, the country's oil use has surged from 2 mb/d in 1990 to 14 mb/d in 2019, according to the BP Statistical Review¹, accounting for 14% of global oil use—which is now reaching 100 mb/d—and representing almost half of global oil demand growth over that period. China is set to remain a key driver of oil demand as it likely overtakes the US as the world's largest economy.

To be sure, the pace of the country's oil demand growth is set to slow, while the makeup of oil product demand is shifting, alongside the restructuring of the Chinese economy and enhanced efforts to curb local air pollution. But the country's recently announced pledge to peak carbon emissions by 2030 and to aim for carbon neutrality by 2060 may not alter this outlook substantially. This is because the government is still planning substantial economic growth over the next decade or so, supporting oil consumption. Moreover, the government's increasing concerns over self-sufficiency and its desire to limit its dependence on imported petrochemicals (which are produced with oil), suggest the country's petrochemical industry will remain a large consumer of oil for years to come.

Oil demand still rising

Over the coming decade, China's oil demand is estimated to rise by anywhere from 2-4 mb/d², a substantial

volume in the global context, but a far cry from the 9-10 mb/d of growth recorded over the past two decades³. Moreover, in the 2030s it will start to fall. The expected strength in demand stems from the fact that per capita oil use in China is roughly a third of OECD levels and the share of oil in the energy mix, at under 20%, is also around half of that in most OECD countries. While oil penetration is likely to remain low by international standards due to structural declines in oil intensity—which tend to occur naturally as per capita GDP grows and in light of the Chinese government's policy efforts—when considering that China today holds one fifth of global population and accounts for 15% of global GDP, the underlying fundamentals of China's development suggest a growing oil demand profile. In particular, with the government pledging to double the size of the economy again by 2035⁴ and urbanisation continuing, oil demand will remain strong. Rising incomes will drive demand for transport fuels such as gasoline and jet as well as for consumer goods. This marks a shift away from the consumption of industrial fuels such as diesel and fuel oil which have been the main tenets of oil use thus far. When looking further back, to the past 40 years or so, China's oil use has changed considerably: in the early 1980s, more than 50% of China's product slate consisted of fuel oil, used in industrial applications and heating, but was gradually displaced with diesel. The 2000s saw a steep rise in diesel consumption as construction activity and industrial output surged. The 2010s then saw a sharper move toward gasoline with rising demand for passenger cars and mobility. And as China's population becomes wealthier and takes more flights, air travel and the related demand for jet fuel is set to increase. Finally, a more consumer-oriented society will drive demand for petrochemicals, used in the production of electrical appliances, in packaging (of consumer goods but also of food deliveries) and in medical equipment.

Historically, diesel consumption accounted for almost one-third of total oil use and has been the largest driver of China's oil demand growth. Roughly one third of all diesel consumed in the country was used in industry, by mining and construction equipment for industrial activities as well as small-scale diesel generators, with an additional two-thirds in freight and commercial vehicles. But China's industrial diesel demand (consisting of both diesel and historically of fuel oil too) is now peaking, as the economy is shifting from an investment-led economy to one driven by consumption. Any future growth in diesel demand is set to come overwhelmingly from freight and shipping—as diesel-fuelled trucks delivers goods across the country, but diesel consumption in construction and industry is set to slow. Here too, though, government policies are increasingly supporting diesel substitutions as part of the

decade before peaking and then falling.

1. BP Statistical Review of World Energy, 2020.

2. According to OIES research based on CNPC, IEA, BP. Estimates for China's oil demand growth vary among institutions but are taken here to include oil products and chemicals. It is also important to note that different conversion rates from Mt to bpd can alter the outlook. Regardless of the variations, most estimates see China's oil demand rising by 15-25% over the course of the next

3. Based on BP Statistical Review (2020) data and China's National Bureau of Statistics data.

4. "Xi says China's economy has hope, potential to maintain long-term stable development", Xinhua, November 2020.

central government's efforts to tackle local air pollution. For example, the central government is looking to encourage a move from road freight to rail and water, in a bid to limit tail-pipe emissions. In addition, the government is encouraging the use of LNG trucks and electric buses to replace diesel use in large freight and public fleets.

FIGURE 1 • EVOLUTION OF CHINA'S OIL DEMAND, THOUSANDS BARRELS PER DAY⁵

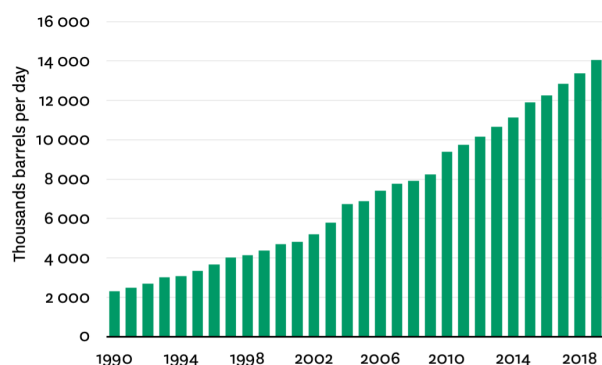
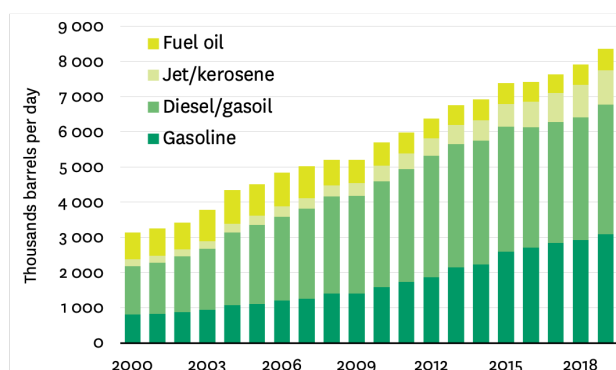


FIGURE 2 • CHINA'S OIL DEMAND BY SELECTED PRODUCTS, THOUSAND BARRELS PER DAY⁶



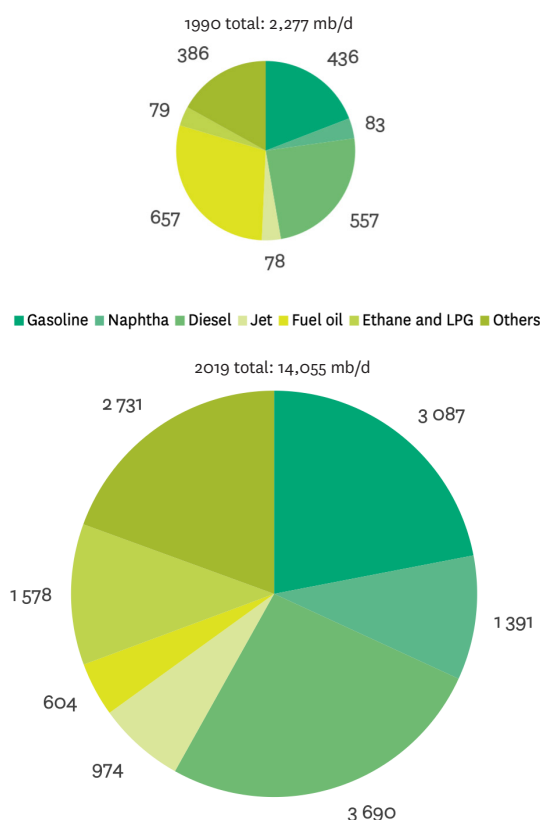
China's state owned oil majors expect demand for transport fuels to peak in 2025 at around 14.6 mb/d, earlier than they had previously expected and at a slightly lower level of than the 14.8 mb/d⁷. So, the government's twin 2030-2060 pledges have impacted the outlook slightly, but with demand for chemicals still rising, overall demand for oil products will continue to grow until the early 2030s and only then start to fall, with little change from previous forecasts.

When does it peak and how steep will the decline be?

Even as developed economies are looking at transitio-

ning away from fossil fuels, emerging countries such as China are still expecting several years of growth. Environmental pledges combined with industrial programmes to electrify their vehicle fleets, for example, will determine when these countries' oil demand will peak, and perhaps more importantly how rapidly it will decline thereafter. For China, part of the uncertainty lies in the country's ambitious plans to electrify its vehicle fleet and its impact on gasoline demand. For example, between 2008 and 2018, due to the phenomenal growth of China's private car fleet, gasoline demand grew by 1.7 mb/d, accounting for over a third of total product demand growth, according to NBS data, with diesel demand (for freight), jet fuel demand and chemicals all accounting for the remainder of growth. With a fleet of just over 200 million in 2020 and private car ownership well below Western levels, there is scope for the fleet to double again in the next twenty years. Yet gasoline use is set to grow at lower levels than those witnessed so far. This is due to China's policies to curb local air pollution; its ambitions to become a technological leader in electric vehicles as well as changes in mobility, related to the development of the electric vehicle (EV) industry in China.

FIGURE 3 • CHINA'S OIL DEMAND BY PRODUCTS, 1990 VS. 2019⁸



First, as air pollution has become a growing area of social consternation, the government has stepped up its

5. Source: BP Statistical Review 2020, BP, 2020.

6. Source: Ibid.

7. CNPC 2050 Outlook, 2020.

8. Source: BP Statistical Review 2020, BP, 2020.

efforts to limit local pollutants, with the transport sector a major focus. Government-mandated fuel economy standards in China continue to tighten. In 2010, average fuel consumption limits for passenger vehicles were 8.2 litres/100 km and are targeted to drop to 5.0 litres/100 km in 2020 and 4.0 litres/km in 2025. Second, the average fuel efficiency of the fleet is also rising as the share of electric vehicles in the fleet grows. Given that China's new energy vehicle policy (NEV - including pure electric vehicles, plug in hybrids, natural gas vehicles and fuel cell vehicles) aims to support the country's industrial upgrade programme as well as efforts to reduce local air pollution, NEVs have benefitted from strong government backing, which has, in turn, led to a rapid commercialisation of NEVs in the country.

As a result, China is currently the world's largest electric car market with over 1.4 million electric cars sold in 2020 and a fleet of close to 5 million units⁹. At the same time, changing mobility habits are leading to a drop in vehicle miles travelled (VMT). Local governments have been restricting car ownership through lengthy and onerous procedures to gain license plates, which have helped increase the attractiveness of car sharing services, while shared bike apps alongside improved public transport have stimulated greater use of the public transport network.

Take Beijing municipality for example. Data from the local transportation research centre shows that VMT fell by half between 2004 and 2017. This is because as the fleet grew, traffic congestion worsened, dampening enthusiasm for driving. At the same time, public transit has improved, with Beijing growing its network dramatically between 2008 and 2016. During those years, Beijing's population rose by 23% while subway ridership grew by more than 150%. At the same time, bike sharing apps, which have flourished in China, have further encouraged commuters to use the improved public transport networks, allowing them to start or finish their journey—"the first/last mile"—rapidly and easily.

In smaller cities, the electric two-wheeler (E2W) and low-speed electric vehicle (LSEV) markets have flourished. The IEA reckons that of the estimated global stock of 350 million electric two/three-wheelers, the majority are in China¹⁰. These mini-EVs may be defining mobility in China's fourth- and fifth-tier cities as they do not require a driver's licence to use and sell for as little as \$1000¹¹. Even though they are made of low-quality parts and lead-acid batteries—which may have other environmental downsides—they allow new drivers to make their leap

into vehicle ownership, thereby also placing them on an electric mobility trajectory. The fate of the mini-EV market will also depend on government regulation, though, as it has developed despite government efforts: Beijing has been concerned about safety standards in mini-EVs and tried to regulate the market, with the large auto-makers also lobbying Beijing to restrict its growth. But even at a slower growth trajectory, mini EVs impact potential gasoline demand growth in the years ahead.

Efforts to electrify China's vehicle fleet slowed slightly in 2020 due to the Covid-19 pandemic and changes to the subsidy scheme. But this trend now seems to be gaining pace once more in light of worsening tensions with a number of Western countries and concerns about technological decoupling. What is more, President Xi's 2030 and 2060 pledges are also pointing to an acceleration of efforts to electrify Chinese cities and energy end-use. The government's New Infrastructure plan, issued in 2020, sets the stage for the country's short-term recovery efforts and its long-term development. It focuses on seven specific fields: 5G networks, data centres, artificial intelligence, the industrial Internet of Things, ultra-high voltage power transmission, high-speed rail, and electric vehicle charging infrastructure.

Already in March, prior to the carbon neutrality pledge, China's top economic planning body, the National Development and Reform Commission (NDRC), announced that it will accelerate the country's transition to NEVs. In response to weaker NEV sales in 2020, the government launched a campaign in July that year to spur purchases in rural areas through road shows and discounts. At the same time, carmakers are offering affordable entry-level models and free charging point installation services, targeting first time buyers and rural consumers who have lower driving range requirements but also access to space for charging facilities¹². As such, in the post-Covid-19 recovery plan, efforts to add charging infrastructure and create a robust digital and technological ecosystem for electric fleets is accelerating the uptake of electric mobility. Already, greater use of artificial intelligence and big data technologies has led to a surge in the use of e-bike and e-scooter sharing platforms in Chinese cities in the aftermath of the Covid-19 outbreak. According to data from bike-sharing companies, before the pandemic, riders looked to bike sharing for the "first" or "last" mile from their home or office to the train stop but now, they are shunning public transport and preferring to take the whole journey by bike. The addition of e-bike and e-scooter sharing platforms makes longer journeys more convenient¹³. With a faster roll-out of sharing platforms and more charging infrastructure, more new drivers may now be on an electric mobility trajectory, albeit with a

9. H. Hui, J. Lingzhi, "How China put nearly 5 million new energy vehicles on the road in one decade" ICCT Blog, January 2021.

10. "Global EV Outlook 2020", International Energy Agency, 2020.

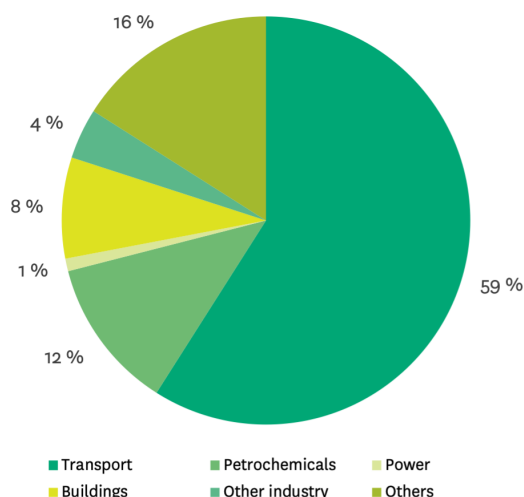
11. G. Collins, "Low-Speed Electric Vehicles: An Underappreciated Threat to Gasoline Demand in China and Global Oil Prices?", Rice University's Baker Institute for Public Policy issue brief, May 2019.

12. A. Limin, D. Jia, "China Eyes Rural Market to Expand NEV Sales", Caixin, July 2020.

13. W. Ma Wenyan, "Here are 4 major bike-sharing trends from China after lockdown", World Economic Forum, July 2020.

wide variation between provinces in terms of affordability and range of models. Also, given the differences in local government support for charging infrastructure, both for private and public fleets, the picture across the country is likely to vary¹⁴.

FIGURE 4 • END USE FOR OIL IN CHINA IN 2018¹⁵



This combination of new infrastructure to support the post-Covid 19 recovery and the added momentum around China's climate ambitions suggest a focus on NEV production and sales as well as the infrastructure to enable a rapid rollout. Indeed, the Chinese government would like NEVs to account for 20% of new vehicle sales by 2025. So if gasoline demand in China was previously expected to peak in the late 2020s at around 3.5-3.6 mb/d, it may now peak in the mid-2020s at a slightly lower level of around 3.4 mb/d. But gasoline use is unlikely to drop sharply for several years thereafter: First, for NEVs to account for roughly 20% of sales by 2025, sales would need to more than double from current levels (assuming overall vehicle sales stabilise), requiring a massive scaling up of the supply chain. Already in 2021, though, a shortage of semi-conductors is plaguing auto production in the country suggesting that supply chains could become a constraint to rapid growth. In addition to constraints to NEV manufacturing—due to potential raw material constraints—charging infrastructure will need to be rolled out and added rapidly; connections to the grid will need to be made and power supplies adjusted¹⁶. What is more, even with 20% of new sales provided by NEVs, there would still be a large internal combustion engine vehicle fleet. Put simply, NEVs will chip away at new sales, but will take time to displace the over 200 million strong vehicle fleet.

14. A number of provinces have committed to electrifying their public fleets while others are focusing on private charging infrastructure, the regional profile in China varies. See for example: J. Lingzhi Jin, H. Hui, "Comparison of the electric car market in China and the United States", ICCT working paper, 2019.

15. Source: BP Statistical Review 2020, BP, 2020.

16. Connecting EVs to the grid is also an opportunity to decarbonise the grid. See for example: B. Finamore, B. Mi Kim, "How EV Charging Can Clean Up China's Electricity Grid", NRDC Blog, June 2020.

Refining capacity still growing

With oil demand therefore still expected to grow, albeit at a slower pace and likely peaking earlier than previously estimated, China's refining system continues to grow. In stark contrast to refinery shutdowns globally, there are over 2 mb/d of new refining additions planned through 2025 in China¹⁷. For now, the government shows no sign of slowing the pace of refining starts, in part because new plants are being built by private companies – as part of the government's effort to open the sector to non-state actors – and because they are integrated petrochemical plants, which support the government's goal of self-sufficiency in chemicals. This switch to petrochemical output has been in the making for several years, with the state-owned refiners also looking to value-added products to help them compete in the global market and maximize profitability. This suggests that China's demand for crude oil as a refinery feedstock will continue to grow for as much as a decade and when it peaks, will flatline before falling.

Conclusion

While Covid-19 cast doubts about China's economic recovery and appetite for oil, its strong economic rebound has led to a surge in oil use. And despite the government's 2030 and 2060 climate pledges, oil use due to a rapid urbanization and a rising middle class will continue to increase, even though growth rates will be tempered by the government's commitment to curbing pollution. Small changes to mobility trends, and even gradual shifts from road freight and air travel to rail, will weigh on China's demand growth through 2040, bringing China's consumption higher by closer to 3 mb/d than to 4 mb/d. Refiners, in light of the excess product supply domestically, are aligning themselves with the government's ambition to shift towards specialty-chemical growth, reflecting the increasing sophistication of consumer demand and China's industrial output.

Covid-19 seems to have exacerbated the product over-supply and accelerated the shift to chemicals. Going forward, the government's twin focus on economic recovery and accelerated electrification of energy end-uses could soften the outlook for oil demand. Electrification will be supported by efforts to add charging infrastructure and the creation of a robust digital and technological ecosystem, which in turn could support shared e-mobility. Despite this altered outlook, however, China will remain a key driver of oil demand growth for another few years, and thereafter will remain one of the largest oil importing countries in the world.

17. "China's oil product demand to peak by 2025: Sinopec", Argus Media, December 2020.



Anders Hove • Project Director,
Chinese-German Energy Transition Project,
Deutsche Gesellschaft für Internationale
Zusammenarbeit GmbH (GIZ)

Renewable Energy: Is China's Innovation System Adequate to Enable a Low-Carbon Transition?

72

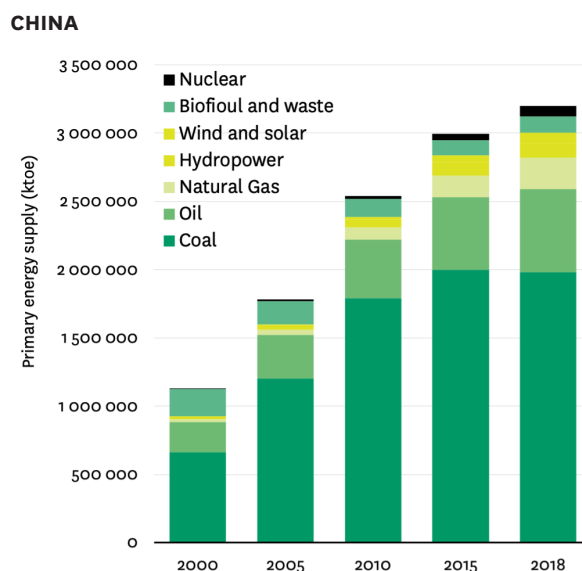
China has made extraordinary progress on renewable energy over the past decade, and in several respects is the world clean energy leader. China leads in terms of total installed capacity of wind, solar, and hydroelectricity, and its manufacturing scale-up of wind, solar, and energy storage have played a central role in making these technologies economically viable worldwide. However, China still obtains the vast majority of its electricity and total primary energy from coal and fossil fuels. Variable wind and solar combined accounted for 9.3% of electricity production in 2020, far lower than in several European countries. (The EU generated 23% of its electricity from wind and solar in 2019, Germany 28%, and Denmark 58%.) However, China's renewable share has steadily increased. China has supported renewable energy through a suite of policies, beginning with capacity targets, subsidies, and feed-in tariffs and transitioning towards other more complex supports including renewable obligations, priority dispatch, and ultimately market-oriented reforms in the power and emissions trading fields. At present, China's high-level policy guidance contains a mixture of elements that support continued investment in fossil energy for energy security and long-term guidance promoting a transition to carbon neutrality by 2060, which will entail an immense scaling up of wind and solar, likely at least ten times the present installed capacity of these technologies (Figure 1).

China has surprised observers with its ability to become (in the phrase of Zhang Sufang and Philip Andrews-Speed) a clean energy champion¹, in terms of institutional changes that have shifted the incentives around utilization of renewable energy as well as efforts to promote innovation. Presently available wind, solar, and energy storage technologies are manufactured and widely commercia-

1. P. Andrews-Speed et al. S. Zhang, *China as a Global Clean Energy Champion: Lifting the Veil*, Palgrave Series in Asia and Pacific Studies, 2019.

lized. A review of recent technology announcements as well as scholarly literature suggests that China has developed substantial ability to further innovate in the renewable energy field, particularly in solar and energy storage, though more focused on incremental gains and manufacturing scale-up. At the present state of development of wind, solar, and storage, this may suffice to enable China's electric power sector to complete a low-carbon energy transition by mid-century.

FIGURE 1 • COMPOSITION OF PRIMARY ENERGY SUPPLY IN CHINA



China's progress in renewables

Renewable capacity

Wind and solar energy capacity in China has increased tenfold in ten years' time². By the end of 2019, the solar PV and wind installation in China each accounted for 35% of the world's total. And China's wind and solar capacity continued to grow apace in 2020. By the end of 2020, the installed capacity of wind reached 282 GW, solar reached 253 GW, and hydro reached 396.63 GW³. These figures represent a substantial overachievement of China's 2020 targets for hydro (340 GW), wind (210 GW), and solar (110 GW)⁴. Since 2010, this represents a compound annual growth rate of 102% for solar, which has grown by a factor of 1150, and a compound annual growth rate for wind of 68.8% for wind, which has grown by a factor of 8.1⁵.

- Emiliano Bellini, "World now has 583.5 GW of operational PV", PV-magazine, avril 2020 ; "International Renewable Energy Agency Database", International Renewable Energy Agency, consulted on January 13 2021.
- "2020年全社会用电量同比增长3.1%", National Energy Administration, janvier 2021 ; "2019年电力工业统计基本数据一览表", China Electricity Council, June 2020.
- "国家发展改革委 国家能源局关于印发能源发展"十三五"规划的通知", National Development and Reform Commission, January 2017.
- "2010年电力工业统计基本数据一览表", China Electricity Council, April 2013.

Renewable manufacturing

China's build-out of clean energy capacity has proceeded in parallel to a huge expansion of its manufacturing base. By the end of 2019, China had silicon wafer production capacity of 173.7 GW, accounting for 94% of the world's total, according to China Photovoltaic Industry Association⁶. China was also home to 63% of the world's total cell manufacturing capacity and to 58% of module manufacturing capacity in 2019⁷. China's wind turbine production accounted for over 40% of world total production by March 2020⁸. (EU manufacturers accounted for around 44% of wind in 2018⁹). According to Bloomberg New Energy Finance, in early 2019 China had a lithium-ion battery cell manufacturing capacity of 316 GWh, which accounted for 73% of global li-ion battery manufacturing capacity¹⁰. (The EU share in 2019 was roughly 3%¹¹).

Renewable energy production

In 2019, 27.9% of electricity generated in China came from renewable sources. Total renewable energy production has increased 46.8% since 2010, when it accounted for just 19.0% of electricity generated¹². The growth rate of renewable energy output has exceeded that of fossil fuel sources in each year since 2015, with renewable output growing at a compound annual rate of 9.6% compared to 5% for fossil sources¹³. According to China's draft Energy Law, renewable energy should supply the majority of China's incremental growth in energy demand in the coming decades (no specific official time frame yet)¹⁴. Coal is still also growing, hence so are the carbon emissions of the electricity sector.

China is in the middle of a major effort to reform its power sector and revolutionize energy production and consumption

China's renewable energy build-out began in the first decade of the 2000s, but early on energy officials realized that a clean energy transition would depend on institutio-

nal and market reforms, particularly in the power sector. Power market reforms began in earnest in early 2015, with the issuance of Document #9 on Deepening Reform in the Power Sector¹⁵, a document that built on earlier central government decisions to increasingly allow the market to play a decisive role in allocating energy and environmental resources (2014)¹⁶, and undertaking a revolution in energy consumption, production, and technology (2014)¹⁷.

Power market reform benefits lower costs to consumers and the expansion of clean energy by ensuring resources with low marginal costs of production—namely wind and solar, which have production costs near zero—take priority in electricity system dispatch. In China, the present sequence of power market reforms began with the publication of an overall framework for reforms in early 2015, and the subsequent 2016 introduction of mid-to-long term bilateral contracts between generators and large industrial customers. These contracts, typically for a month or year in duration, replaced earlier contracts between generators and grid companies that mandated each plant operate for a fixed number of hours at regulated prices¹⁸. This was followed by reform of transmission and distribution tariffs for both new and existing grids¹⁹, establishment of new markets for ancillary services²⁰, and ultimately ongoing efforts to establish provincial and regional spot power markets²¹.

As of 2021, China's spot markets remain at an early stage of development: provincial pilots have begun with simulated trading between a limited number of players, and advanced to the level of actual trading between market participants during short periods. Spot market prices published in late 2020 suggest thin trading at prices below the marginal cost of production, indicating that these markets suffer from market inefficiencies and oversupply²². However, time-variant prices have also shown a considerable response to changing intra-day supply-demand conditions.

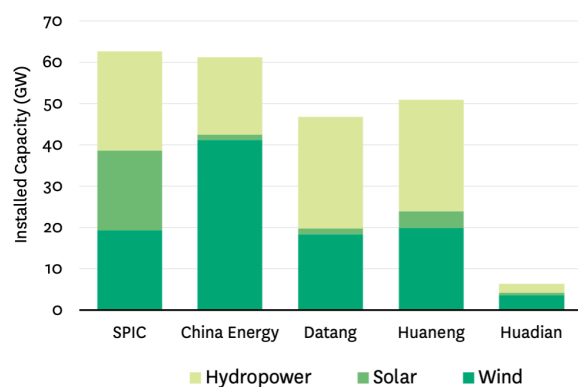
6. Reuters Staff, "China to restrict expansion of solar equipment producers", Reuters, May 2020.
7. T. Andre et al., "Renewables 2020 Global Status Report", REN21, 2020.
8. B. Chen, "China's wind turbine manufacturing ecosystem and its potential" Mirae Asset, 2020.
9. "Vestas takes global OEM lead in 2018 – GWEC", Global Wind Energy Council, April 2019.
10. R. Rapier, "Why China Is Dominating Lithium-Ion Battery Production", August 2019.
11. I. Tsiropoulos et al., "Li-ion batteries for mobility and stationary storage applications", Joint Research Centre, European Commission, 2019.
12. "国家能源局2020年一季度网上新闻发布会文字实录", National Energy Administration, March 2020; "国家能源局：2010年能源经济形势及2011年展望", National Energy Administration, January 2011; "国家能源局关于2015年度全国可再生能源电力发展监测评价的通报, 国能新能[2016]214号", National Energy Administration, August 2016.
13. "2019年电力工业统计基本数据一览表", China Electricity Council, June 2020.
14. "国家能源局关于《中华人民共和国能源法（征求意见稿）》公开征求意见的公告", National Energy Administration, April 2020.

15. "Opinions on Deepening Reform of the Electricity System, Central Committee No. 9", Central Committee of the Communist Party of China and State Council, March 2015.
16. "习近平:正确发挥市场作用和政府作用 推动经济社会持续健康发展", Xinhua News Agency, May 2014.
17. "习近平：积极推动我国能源生产和消费革命", Xinhua News Agency, June 2014.
18. "电力中长期交易基本规则(暂行)", 发改能源〔2016〕2784号, National Development and Reform Commission and National Energy Administration, 29 December 2016.
19. "国家发展改革委关于印发《区域电网输电价定价办法》的通知, 发改价格规〔2020〕100号", National Development and Reform Commission, January 2020; "展改委关于印发《省级电网输配电价定价办法》的通知, 发改价格规〔2020〕101号", National Development and Reform Commission, January 2020.
20. "完善电力辅助服务补偿(市场)机制工作方案, 国能发监管〔2017〕67号", National Energy Administration, November 2017.
21. "国家发展改革委办公厅 国家能源局综合司印发《关于深化电力现货市场建设试点工作的意见》的通知, 发改办能源规〔2019〕828号", National Development and Reform Commission and National Energy Administration, August 2019.
22. L. Shan, et. al., "电力现货还能走多久?", China Energy News, January 2021.

Though functioning and liquid spot markets are likely a precondition to enabling market forces to drive economic dispatch of clean energy, the government has also increasingly required priority dispatch for renewable energy through a combination of administrative targets, requirements, mandates, and incentives²³. For example, Rule 625 in 2016 required grid companies compensate renewable generators for curtailed energy²⁴. As a result of these and other measures, curtailment of wind and solar has fallen to low levels. In 2019, wind curtailment amounted to 4% down from 7% in 2018 and a peak of 17% in 2014²⁵. The solar curtailment also fell in 2019 to 2% from the peak of 11% in 2015²⁶.

One factor that affects the progress of the clean energy transition in China is that state-owned companies continue to dominate the power sector. In most countries, incumbent utilities—whether state-owned or private—have tended to retain fossil fuel assets while new entrants invest in smaller wind and solar capacity. In China, by contrast, SOEs have led the wind and solar build-out. By the end of 2019, the installation renewable energy capacity of the Big 5 state-owned generation company accounted for almost 30% of China's total renewable installed capacity—with highest shares of wind and hydro²⁷ (Figure 2). Many solar plants are owned by SOEs other than the Big 5²⁸.

FIGURE 2 • INSTALLED RENEWABLE CAPACITY BY BIG-FIVE GENERATION GROUP BY THE END OF 2019²⁹



The substantial SOE ownership of power sector assets, including renewable energy assets, means that reforms to

institutions and markets that worked in other countries may not produce the same results in China. For example, SOEs facing carbon prices may have different compliance incentives than private firms, but are officially responsible for implementing government directives³⁰. In addition, national energy policies are set within a subsystem that comprises state-owned energy think tanks, industry officials, and provincial energy officials³¹. China's economic and energy planning process place a high value on socio-economic stability, as reflected in various priorities such as provincial growth and employment numbers, solvency of large state-owned firms and banks, provincial tax revenue and economic transfers, reliable supply of energy, and provincial self-sufficiency.

The long-term transition to clean energy will alter some of these relationships, and may depend on creating new, more long-term market incentives that signal officials, investors, and firms to invest now in renewables and avoid fossil investments. China has adopted several market reforms that have the potential to supplement or replace administrative targets and subsidies for clean energy, but oriented those reforms towards short-term compliance. For example, China's Renewable Obligation, which requires provinces and grid companies meet certain percentages of renewable consumption, only includes targets 2-3 years out³². Similarly, China's newly-established carbon emissions trading system (ETS) focuses on compliance by large firms in the power sector using emissions benchmarks for coal and other thermal plants, instead of a cap-and-trade or carbon tax³³. Benchmarks are currently set just a year in advance. Therefore, the RO and carbon ETS provide no market signal that could incentivize future clean energy investment, or disincentive to invest in coal or other fossil infrastructure—except to the extent that market players can anticipate future government decisions on how these mechanisms will evolve over time based on long-term government targets³⁴. Hence, targets such as carbon peaking before 2030 and carbon neutrality by 2060, and how local officials implement them, play an outsized role in setting SOE investment decisions and provincial investment approvals.

Although these enabling institutions and markets in

23. “国家发展改革委 国家能源局关于规范优先发电优先购电计划管理的通知，发改运行〔2019〕144号”，National Development and Reform Commission and National Energy Administration, January 2019.

24. “可再生能源发电全额保障性收购管理办法，发改能源〔2016〕625号 [Renewable Electricity Full Purchase Guarantee Management Act, NDRC (2016) No. 625],” National Development and Reform Commission Number 625, 24 March 2016.

25. “2019年风电并网运行情况”，National Energy Agency, 28 February 2020.

26. Ibid.

27. S. Sang, “大幅提升光伏规模！国家能源集团计划未来5年新增25-30GW装机”，Beijixing, October 2020.

28. “36家企业持有全国42%的光伏电站 民企为光伏电站投资中坚力量”，Century New Energy Network, mars 2019.

29. Sources : Beijixing, 2020.

30. P. Benoit et A. Clark, “Making State-Owned Enterprises Work for Climate in China and Beyond”, Columbia Center on Global Energy Policy, September 2020.

31. P. Andrews-Speed, Z. Sufang, *China as a Global Clean Energy Champion*, Palgrave Macmillan, 2019.

32. “国家发展改革委 国家能源局关于建立健全可再生能源电力消纳保障机制的通知，发改能源〔2019〕807号”，National Development and Reform Commission and National Energy Administration, May 2019.

33. “碳排放权交易管理办法(试行)，生态环境部令，第19号”，Ministry of Ecology and Environment, December 2020 ; “关于印发《2019-2020年全国碳排放权交易配额总量设定与分配实施方案（发电行业）》《纳入2019-2020年全国碳排放权交易配额管理的重点排放单位名单》并切实做好发电行业配额分配工作的通知，国环规气候〔2020〕3号”，Ministry of Ecology and Environment, December 2020.

34. A. Hove, “Trends and Contradictions in China's Renewable Energy Policy”, Columbia University, Center on Global Energy Policy, août 2020.

China at present appear to offer only modest support for the clean energy transition right now, there is widespread recognition in Europe and the U.S. that the low-carbon transition will require a mix of market and administrative actions, and that market reforms such as spot markets and carbon prices are not a panacea³⁵. Arguably, markets have played a peripheral role in growing wind and solar capacity in Europe and North America; rather, renewable portfolio standards, government targets, subsidized R&D, and feed-in tariffs/net metering have played a larger role³⁶.

Ultimately, carbon prices and clean energy trading may be most effective only after clean energy has established itself as an economically viable and cost-competitive industry with its own political base of support and proof that countries with high shares of variable wind and solar can function without power cuts or unacceptable price spikes. In other words, in Europe and the U.S., initial policy supports created positive policy feedbacks that ultimately lead to supportive institutions (spot markets that prioritize renewable energy, utility regulators and utility companies that accept consumer-generated electricity, and so on) that continue to support clean energy after support for subsidies fades³⁷.

In this context, China has arguably successfully set the stage for such positive policy feedbacks, both through high-level support for a change in energy paradigms and institutions, and through creation of a strong domestic clean energy industry embedded within the existing technoeconomic regime of China's power sector. If this positive policy feedback continues, provincial officials and SOEs may increasingly see rising returns on investments in clean energy, despite present incentives still favoring investment in long-lasting fossil assets. However, many barriers remain:

- an energy sector paradigm that favors stable electricity generation from centralized power plants owned by powerful SOEs, and stable energy supply from domestic fossil fuels;
- long-standing policy-maker concerns about employment in the coal sector, including in mining and power generation;
- an administrative planning institutional design that could resist allowing the spot market or carbon market to play a larger role in setting energy prices;
- an institutional imperative to prevent financial

risks at SOE power companies that own fossil fuel assets, and among provincial governments with financial or economic exposure to fossil fuel industry.

These factors suggest a long period of gradual change in energy mix, even as the economics of renewable energy improves and the case for new fossil fuel investment declines.

Does China have the technology and innovation to reach carbon neutrality?

China needs approximately 10x the wind and solar to reach goals

Growing renewable energy is a central strategy for achieving China's goals of peaking carbon emissions before 2030 and reaching carbon neutrality by 2060. Various Chinese and international analysts have developed long-term carbon neutrality projections and pathways, all of which place renewable energy at the center.

- An analysis by the Institute of Climate Change and Sustainable Development at Tsinghua University, released in late 2020 shortly after China announced the 2060 climate neutrality goal, projects that non-fossil fuels, including nuclear, would provide 85% of primary energy by 2050, much of this coming from renewable sources³⁸. According to Tsinghua University, the vast majority of coal plants will be retired well prior to 2050 and only a small portion will be retrofitted with Carbon capture and storage technology (CCS).
- A 2019 analysis from the China National Renewable Energy Centre projects that under a 2.0°C scenario, China would derive 58% of primary energy from renewables by 2050, which would entail installation of 2600 GW of wind and 2800 GW of solar by that time, a little over 10x year-end capacity in 2020³⁹.
- Under the most ambitious projection, a 2020 Lawrence Berkeley National Laboratory study suggested that if current wind and solar cost trends continue, China could reach 62% of energy from renewable sources at a lower cost than under a business-as-usual scenario as early as 2030, which would entail roughly 2,000 GW each of wind and solar capacity⁴⁰.

35. J. D. Jenkins, "Political economy constraints on carbon pricing policies: What are the implications for economic efficiency, environmental efficacy, and climate policy design?" *Energy Policy*, 2014 ; D. Rosenbloom et al., "Opinion: Why carbon pricing is not sufficient to mitigate climate change — and how 'sustainability transition policy' can help", *Proceedings of the National Academy of Sciences of the United States of America*, avril 2020.

36. F. W. Geels et al., "Sociotechnical transitions for deep decarbonization", septembre 2017.

37. L. C. Stokes, "Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States", Oxford University Press, 2020.

38. H. Jiankun, "Launch of the Outcome of the Research on China's Long-term Low-carbon Development Strategy and Pathway", Tsinghua University, Institute of Climate Change and Sustainable Development, October 2020.

39. "China Renewable Energy Outlook 2019: Executive Summary", Centre national chinois des énergies renouvelables, Institut de recherche sur l'énergie de la Commission nationale du développement et de la réforme, 2020.

40. G. He et al., "Rapid cost decrease of renewable energy and storage offers an opportunity to accelerate the decarbonization of China's power system", Division de l'analyse énergétique et des incidences environnementales, Lawrence Berkeley National Laboratory, March 2020.

These targets and projections are undoubtedly ambitious, but are far greater than the growth already experienced in China's wind and solar sectors over the past decade, which relied heavily on subsidies and supportive policies. In the future, expansion of renewable energy will depend mainly on favorable economics and (as discussed below) market reforms.

Price declines will continue

After accounting for the declining costs of renewable energy, projections of rapid scale-up of wind and solar appear more practical. Worldwide, the International Renewable Energy Agency (IRENA) noted in 2020 that three-quarters of new wind plants and two-fifths of new solar plants cost less than building new fossil fuel plants, and renewables are increasingly competitive with the operating cost of existing fossil plants⁴¹. In China, where subsidies for new wind and solar projects are gradually being removed, some new wind and solar projects are already cheaper than coal grid tariffs, and the China Solar Industry Association has predicted solar PV could reach parity in 2021⁴². A 2019 analysis of Chinese utility-scale solar PV project costs published in *Nature Energy* found that unsubsidized PV projects were already cheaper than coal tariffs in most Chinese cities and provinces⁴³. A 2021 analysis from the Rocky Mountain Institute also shows that in 2020 the auction prices for new subsidy-free solar projects was at or near the coal tariff in most Chinese provinces, and that 2021 solar auction prices would likely fall below coal tariffs. The analysis also suggested that wind levelized cost of electricity (LCOE) is already below provincial coal tariffs⁴⁴.

The price declines for wind and solar are feeding directly into activity on the ground. Since 2018, China has gradually sought to scale back or eliminate subsidized feed-in tariffs for utility-scale onshore wind and solar PV. China's present support scheme for wind and PV entails bidding for 20-year power purchase contracts at or below local coal prices. In 2019, China approved 4.5 GW of subsidy-free wind and 14.8 GW of subsidy-free solar PV⁴⁵. The amounts for 2020 (through November) have more than doubled to 11.4 GW of wind and 33 GW of solar⁴⁶.

Achieving cost parity is only part of the picture: which

41. "Renewable Power Generation Costs in 2019", Agence internationale pour les énergies renouvelables (IRENA), juin 2020.

42. Y. Yu, "China's Solar Market: Renewable Investors' Critical Battlefield" *Energy Iceberg*, octobre 2020.

43. J. Yan et al., "City-level analysis of subsidy-free solar photovoltaic electricity price, profits and grid parity in China", *Nature Energy* 4, août 2019.

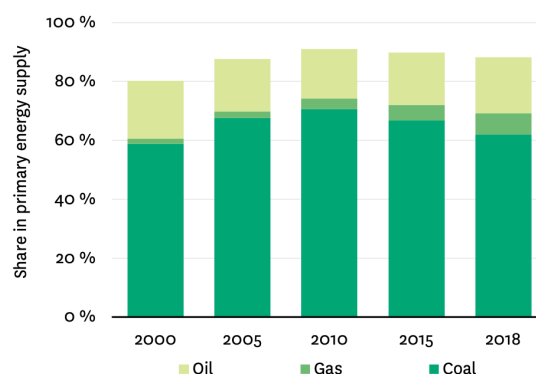
44. Y. Cao et al., "China Zero-Carbon Electricity Growth in the 2020s: A Vital Step Towards Carbon Neutrality", Rocky Mountain Institute, à paraître en 2021.

45. "国家发展改革委办公厅 国家能源局综合司关于公布2019年第一批风电、光伏发电平价上网项目的通知", Nation Energy Administration, May 2019.

46. "国家发展改革委办公厅 国家能源局综合司关于公布2020年风电、光伏发电平价上网项目的通知", National Development and Reform Commission, July 2020.

power plant gets built depends on more than just the levelized cost of energy. The variable output of wind and solar generally requires improved flexible operations of dispatchable plants, transmission lines to send renewable energy to a wider geographical area (which reduces variability, particularly for wind), demand that can respond dynamically to short-term changes in energy supply, and potentially energy storage. According to analysis by China's Energy Research Institute and GIZ, China's power system is presently less flexible than those in Germany, which hinders uptake of variable renewable sources, though this could be resolved in a relatively short time and needn't pose an insuperable technical barrier to China's 2060 carbon neutrality goal⁴⁷. As renewable costs decline, momentum will build towards resolving technical, institutional, policy, and market barriers to the clean energy transition.

FIGURE 3 • SHARE OF FOSSIL FUELS IN PRIMARY ENERGY SUPPLY IN CHINA⁴⁸



Future RE growth depends on both scale-up and innovation, and China is becoming more innovative—at least in some fields of clean energy

Clean energy journalists and proponents have cited Moore's Law and Ray Kurzweil's Law of Accelerating Returns to support the idea that clean energy worldwide could scale up far more rapidly than implied by most conventional energy forecasts⁴⁹. For example, a 2014 article in *Greentech Media* cited Kurzweil in projecting that solar could dominate electricity production in less than 20 years, and a similar 2013 article from an EV proponent suggested battery electric vehicles could dominate vehicle markets worldwide by 2030⁵⁰. Wind and solar are already at or near price parity on a levelized cost basis, but will price declines continue, and does this depend on China's innovative capacity?

47. Z. Yanan et al., "A Quantitative Comparative Study of Power System Flexibility in Jing-Jin-Ji and Germany", National Development and Reform Commission, Energy Research Institute, December 2020.

48. Sources : IEA, 2020.

49. R. Kurzweil, "The Law of Accelerating Returns", Kurzweil Accelerating Intelligence, March 2001.

50. T. Hunt, "Are We Halfway to Market Dominance for Solar?", *Greentech Media*, avril 2014 ; Z. Shahan, "Electric Cars May Be About 50% On Their Way To Market Domination", *EV Obsession*, December 2013.

Economic literature on learning rates and their application to clean energy can provide various answers to this question. First, looking at worldwide cumulative production of wind and solar, there exist a range of estimates of the learning rate—the decline in cost for each doubling of capacity for a given technology—show that wind’s learning rate is roughly 5-10%, solar 20-30%, and battery energy storage 20%⁵¹. Based on these learning rates, hybrid renewable facilities combining wind, solar, and energy storage would become economical before the mid-2020s⁵².

These numbers mask the many different factors that underlie the cost declines. For example, a 2018 MIT study showed that in the 1990s and 2000s solar PV cost declines were driven by R&D and technology diffusion, whereas in the late 2000s and early 2010s manufacturing scale-up and related knowhow were more important⁵³. Today, wind and solar PV have reached the full commercialization stage, while battery energy storage is at the early stage of scale-up.

Anecdotally, Chinese companies and universities regularly announce innovative technologies at both the lab and manufacturing scale. For example:

- 2020 NIO announced solid-state batteries with an energy density of 360 Wh/kg, and plans to install them in vehicles by the end of 2022⁵⁴.
- The 150 MW floating solar power plant in Huainan, Anhui, was the world’s largest floating solar power plant when installed, featuring an innovative floating body and anchoring design. The company also tested the performance of different PV modules on water, including monocrystalline PERC, HIT, bifacial N-type monocrystalline, and stacked sheets⁵⁵.
- In March 2020, Trina Solar began selling ultra-high-power modules over 500 W of power and efficiency over 21%. The products integrated large silicon wafer, non-destructive cutting, and high-density packaging⁵⁶.
- Innovations in wind power center on large-scale, low-velocity blade technology. Sino Wind Energy Group produced the longest 2 MW blades, at 59.5 meters. In terms of blade material, Sinoma Science and Technology invented high-strength si-

licon-aluminum-magnesium glass fiber, to be used for increasingly larger blades⁵⁷.

China has the necessary infrastructure to support clean energy innovation in the long-term, which should help ensure that clean energy continues to develop and improve. Namely, China has policies to directly support and fund innovation, the country’s energy R&D spending is substantial, the country’s environmental and energy policies are favorable to long-term development and deployment of clean energy, and companies are given clear direction for innovation in clean energy.

China has adopted policies to support and guide clean energy innovation:

- China’s 13th Five-Year Plan for solar development listed various solar technology targets, aiming to increase advanced crystalline silicon PV cell industrialization conversion efficiency to 23%, and develop thin film technology⁵⁸.
- The National Development and Reform Commission in 2016 also set strategic development targets for wind power. The government highlighted four areas for innovation: large-scale wind equipment, offshore system construction, wind farm cluster operation based on big data and cloud computation, and recycling of waste equipment⁵⁹.
- The National Energy Administration established similar targets for energy storage, emphasizing development of storage with renewable energy, microgrids, reduction in cost of storage, and improvement in safety and security of energy storage⁶⁰.
- In October 2020, the State Council outlined several new energy vehicle technologies as key areas for innovation in the next 15 years. These include battery technology, smart network technology, and charging infrastructure improvement⁶¹.

Overall Chinese R&D spending on clean energy is substantial

China’s spending on energy R&D has risen and accounts for a large amount of the world’s share of government R&D spending. China accounted for around 24% of government energy R&D spending in 2019, according to the IEA, whereas in 2006 China accounted for just 6% of global R&D spending⁶². Government R&D spending in a gi-

51. J. Grafström, and Å. Lindman, “*Invention, Innovation and Diffusion in the European Wind Power Sector*”, Technological Forecasting and Social Change, 2016 ; “*Clean Energy Innovation*”, Agence internationale de l’énergie, 2020 ; X. N. Penisa et al., “*Projecting the Price of Lithium-Ion NMC Battery Packs Using a Multifactor Learning Curve Model*”, Energies, September 2020.

52. X. N. Penisa et al., op.cit.

53. G. Kavlak et al., “*Evaluating the causes of cost reduction in photovoltaic modules*”, Energy Policy 123, December 2018.

54. “*蔚来发布的“固态电池”到底是个啥*”, Financial World, January 2020.

55. “*三峡淮南水面漂浮式光伏电站：打造水面光伏技术创新新样本*”, State-owned Assets Supervision and Administration Commission of the State Council, January 2019.

56. “*光伏企业发力技术创新 迎平价时代挑战*”, Xinhua Finance, March 2020.

57. “*大型风电叶片设计制造技术发展趋势*”, China Science, December 2016.

58. “*国家能源局关于印发《太阳能发展“十三五”规划》的通知*”, National Energy Administration, December 2016.

59. “*中国大型风电技术创新路线图2016-2030*”, Beijixing Wind Power, June 2016.

60. “*国家发展改革委 国家能源局关于印发能源发展“十三五”规划的通知*”, National Energy Administration, January 2017.

61. “*国务院办公厅关于印发新能源汽车产业发展规划（2021—2035年）的通知*”, State Council Office, October 2020.

62. “*World Energy Investment in 2020: R&D and technology innovation*”, International Energy Agency, May 2020.

ven field or industry, especially when sustained over long periods, has been shown to correlate with future innovation in related fields.⁶³ Furthermore, worldwide corporate and venture capital investment into energy R&D has been increasing, and has tended to shift from fossil fuel sectors to more clean energy sectors⁶⁴. In the past, China has benefited from knowledge spillovers from private sector energy R&D due to foreign direct investment in manufacturing as well as through efforts to attract returning scientists and business entrepreneurs⁶⁵. More recently, Chinese overseas investment in clean energy field has the potential to lead to both technology transfer and reverse innovation in China⁶⁶.

Strict environmental regulation and long-term policy support for clean energy also correlate well with clean energy innovation⁶⁷. Over the past decade, renewable energy feed-in tariffs and five-year planning targets have helped scale up the wind and solar sectors. In the future, renewable energy obligations, carbon emissions trading, and provincial targets for carbon peaking are likely to be more important. Such policies both directly influence short-term clean energy investment decisions by energy firms and provincial officials, but help guide decisions about what types of innovative sectors to focus on for longer-term investment.

While China was long thought to be primarily engaged in technology catch-up, and to lack absorptive capacity, this appears not to capture changes over the past decade that result from R&D, stricter environmental targets, and policies that provide long-term support for clean energy. Academic studies have found that China's innovative capacity in clean energy has now at least partially shifted from the technology catch-up to the fully developed stage. Particularly in the solar and energy storage sectors, China appears to have moved towards the center of the world energy technology innovation system⁶⁸. Whereas a decade ago, Chinese companies filed few solar patents and these were rarely cited outside of the industry, in recent years Chinese solar patents are among the most cited within and outside the industry. A similar change has taken place

in energy storage. By contrast, in the field of wind power, where China also leads in annual installations, China's innovation and patent activity appear focused on more peripheral innovation, and the country remains relatively dependent upon foreign technology⁶⁹. Domestic turbines cost less but offer lower performance than those in the U.S.⁷⁰.

Why does China lead in some clean energy technologies but not in all, and what does this portend for the future of clean energy in China? Several factors are at work: First, in terms of the number of patented components, solar and battery technologies appear somewhat simpler, and patent analysis suggests innovation in these fields depends on materials and electronics-related R&D, compared to wind power and other technologies dependent upon both materials and mechanical engineering innovation⁷¹. The wind power market is dominated by a few major players manufacturing large equipment for multi-MW devices, whereas solar and storage feature commoditized manufacturing and high price competition among producers of relatively smaller cells, packs, and modules. China's policies in the wind sector encouraged domestic content requirements and localization of manufacturing under a FIT regime that ensured steady revenues, compared to solar where the globally competitive export market and a multiplicity of players forced innovation to keep up with price declines.⁷²

The above literature suggests that China already has many of the innovation systems and supportive policies needed to continue to expand renewable energy capacity. But will the field experience the kinds of S-curve adoption in China or worldwide anticipated by some industry boosters? Unlike software, home appliances, or consumer electronics –fields where the S-curve of technology adoption and diffusion has ample recent examples– energy technology is generally capital intensive, durable (expected to last decades or more), and dependent upon complex systems such as power grids, supportive power markets, and resource supply (such as steel for wind turbines, and expensive materials such as silver for PV and cobalt and nickel for batteries).

A 2012 review article listed several systemic variables that determine the speed of clean energy technology

63. J. Grafstrom, "Modern era Knowledge Spillovers in the Solar energy sector", Luleå University of Technology Economics, USAEE Working Paper, March 2019.

64. "World Energy Investment in 2020: R&D and technology innovation", National Energy Agency, May 2020.

65. L. Weiwei et al., "Impacts of FDI Renewable Energy Technology Spillover on China's Energy Industry Performance", Sustainability 8(9), August 2016; F. Xiaolan, "Foreign Direct Investment, Absorptive Capacity and Regional Innovation Capabilities: Evidence from China", Global Forum on International Investment, Organization of Economic Cooperation and Development, March 2008; L. Siping et al., "Intellectual Returnees as Drivers of Indigenous Innovation: Evidence from the Chinese Photovoltaic Industry", National Bureau of Economic Research, October 2013.

66. Y. Bai et al., "Can environmental innovation benefit from outward foreign direct investment to developed countries? Evidence from Chinese manufacturing enterprises", Environmental Science and Pollution Research, November 2020.

67. J. Olson Lanjouw and A. Mody, "Innovation and the international diffusion of environmentally responsive technology", Research Policy 25(4), 1996.

68. Y. Wang et al., "Comparing the Technology Trajectories of Solar PV and Solar Water Heaters in China: Using a Patent Lens", Sustainability, 2018.

69. Y. Zhou et al., "Comparing the International Knowledge Flow of China's Wind and Solar Photovoltaic (PV) Industries: Patent Analysis and Implications for Sustainable Development", Sustainability, 2018.

70. X. Lu et al., "Challenges faced by China compared with the US in developing wind power", Nature Energy 1, mai 2016.

71. G. F. Nemet, "Inter-Technology Knowledge Spillovers for Energy Technologies", Energy Economics 34(5), 2012; J. Noailly et V. Shestalova, "Knowledge spillovers from renewable energy technologies: Lessons from patent citations", Graduate Institute Geneva, Centre for International Environmental Studies, 2013.

72. Z. Yuan et al., "Comparing the International Knowledge Flow of China's Wind and Solar Photovoltaic (PV) Industries: Patent Analysis and Implications for Sustainable Development", Sustainability, 2018.

FIGURE 4 • BRIEF EVALUATION OF POTENTIAL BARRIERS AFFECTING DIFFUSION OF RENEWABLE ENERGY IN CHINA

Systematic problems	Current situation in China	Low applicability	Medium applicability
Valley of death for new clean energy technologies	Current wind and solar technologies appear price-competitive and are manufactured at scale by established firms. The valley of death primarily applies to laboratory stage technologies or startup companies.		
Supply or shortage of a qualified work force	China has a well-established clean energy sector and a large workforce of technically-qualified staff at all levels.		
Absence of a local knowledge and innovation infrastructure, including industry, policy, educational, and investors	As noted in the text, China appears to have developed a comprehensive science and technology innovation sector in many fields of clean energy, including solar and storage.		
Industry networks that are either too strong (exclude innovative players) or weak (unable to generate innovation)	The wind, solar, and energy storage industries are now well-established in China and linked to a network of academic institutions and international experts. There are no indications that these industry networks or associations are hindering the development of the clean energy sector through restrictive standards or practices.		
Stop-and-go policy and shifting public attention	China has supported wind, solar, and energy storage with a steady stream of policies. A sudden mid-2019 cut in solar feed-in tariff quotas led to a cliff in installations, though the market recovered.		
Overall industry attitudes and awareness towards clean energy or low-carbon energy transitions	While SOEs and private firms are aware of the country's long-term policy to adopt clean energy and shift away from fossil energy, many power consuming firms lack incentives to adopt clean energy and power sector firms tend to favor near-term expansion of fossil energy-related infrastructure.		
Market structures that favor established technology over variable or distributed RE	Inflexible dispatch practices, limited inter-provincial electricity trading, government-regulated electricity prices, and the lack of formal compensation for electricity ancillary services presently favor coal over renewable energy, though reforms are underway to gradually change this. Investment approval process for coal and renewables excessively oriented towards the short-term and towards meeting peak load via coal plant additions.		
Corporate innovation overly focused on incremental innovation as opposed to breakthroughs	Since wind, solar, and energy storage technologies are already commercial and manufactured at scale, this factor is likely to only affect the choice of renewable technologies—for example, favoring c-Si solar PV over more exotic materials—as opposed to favoring fossil energy.		
Lack of technical capability related to policies, markets, and technologies needed to integrate renewable energy	China has a well-established clean energy sector and has resolved many of the early technical and administrative dilemmas that led to high curtailment of renewable energy. However, China lacks functioning spot markets and is at the early stage of incorporating emissions trading and other market-oriented policies.		
Lack of demand for clean energy, either from consumers or industry	Demand for clean energy comes primarily from policy incentives and targets, though policies have sought to shift towards market-driven demand. Owner-occupant dilemma hinders adoption of distributed energy. Industry has few incentives to favor purchase of clean energy through power purchase agreements or renewable obligation certificates.		
Presence of positive policy feedback loops and industry lobbying in favor of new energy investment	China has a well-established clean energy sector, with supportive industry associations and a mix of small and large renewable energy manufacturers and developers. At the same time, provincial officials, incumbent SOEs, and SOE banks, tend to favor investment in fossil energy.		
Political influence of incumbent industry blocking change	China's institutional structure favors state-owned enterprises and directly involves them in establishing regulations, planning, and governance of the power sector. In many fields, large grid companies and generation companies may outrank ministries or departments with policy or regulatory functions. However, high-level guidance favoring renewable energy and carbon neutrality, along with mandates that SOEs act consistently with high-level party instructions, mitigates this.		
Physical infrastructure access blocked by incumbents	State-owned grid companies have monopoly on grid access, dispatch, and data. Various policies have sought to promote grid access and priority dispatch of renewables as well as addition of new transmission to carry renewable energy between provinces.		

RE: renewable energy

adoption or diffusion⁷³ as shown in Figure 4.

Among the factors listed above, China appears to have overcome some of the major systemic barriers. As noted above, China appears to possess adequate innovation infrastructure, stable and rising policy-driven demand for clean energy, an ample clean energy work force, and positive policy feedbacks from a now well-established clean energy industry and supportive policy environment. In terms of technical policy and market knowhow, and overall energy sector paradigms, China has many experts and

industry leaders advocating for an overall paradigm shift, as embodied and adopted by the central government in the form of policies supporting an overall revolution in energy consumption and production, with the ultimate aim of carbon neutrality by 2060. However, the incumbent power sector paradigm remains strong, featuring centralized generation from large coal and hydro plants, dominated by large, state-owned generation companies and grid companies, and oriented around energy security through ample baseload power.

73. S. O. Negro et al, "Why does renewable energy diffuse so slowly? A review of innovation system problems", Renewable & Sustainable Energy Reviews, 2012.

Conclusion

Though the country's energy system remains reliant on fossil energy sources, China's renewable energy transition is well underway, as shown by rising capacity of clean energy sources as well as gradually rising shares of clean energy production. Institutional reforms are underway as well, including spot markets and carbon trading, though

both are at an earlier stage. The country's innovation system has grown and deepened, enabling China to move on from an earlier period of technology catch up. Given the already favorable economics and present learning rates for wind, solar, and storage, these technologies are likely to continue to grow steadily, making possible a successful low-carbon energy transition within China's power sector.



Mathilde Teissonnière • Assistant to the Nuclear Counselor at the French Embassy in China

Civil Nuclear Energy in China

China's nuclear program is one of the most recent major civil nuclear programs. In forty years, China has managed to gain sufficient maturity to develop its own nuclear technologies and position itself in the international market. It has developed by following the now well-known and much feared principle of "importation, assimilation, sinicization and innovation". Today, the country is the third largest civil nuclear power in terms of installed capacity with 51 GWe, and is expected to rise to be the number one producer in the coming decade, ahead of the United States and France.

The Long March of Chinese Nuclear Power

The Chinese nuclear program initially began for military purposes in the 1950s with the help of the USSR. Despite cooling relations between the two communist regimes, the project was launched and led to its first atomic bomb test on 16 October 1964. It was only after the Cultural Revolution in 1982 that China decided to build its first small, civil nuclear power plant of 300 MWe at the Qinshan site (Zhejiang province), equipped with a pressurised water reactor (PWR).

China first invested in foreign technologies, which it copied and then appropriated to move upmarket. At that time, France appeared to be a strong partner to China.

In 1982, the Chinese Ministry of Nuclear Industry (MNI) and the French Atomic Energy Commission (AEC) signed a "cooperation agreement in the matter of atomic energy's peaceful use." In 1983, a memorandum of nuclear power cooperation was signed, which included the construction of several 900 MW reactors using French technology and contained a clause on technology transfer to China¹. Other countries also contributed their technolo-

gies, such as Canada with its CANDU reactor (Qinshan III nuclear power plant, connected in 2003) and Russia with VVER (two reactors at the Tianwan power plant brought into operation in 2006-2007). During the construction of the Daya Bay plant (two reactors brought into operation in 1993-1994), French technology was chosen as a model for the Chinese Generation 2 reactor system. The Daya Bay nuclear station's technology (3-loop PWR, 900MW) and Framatome's fuel fabrication technology (AFA-2G and AFA-3G) have been used as a basis for the Chinese CPR1000 reactors, sixteen units of which are currently in service.

In total, eight reactors were built between 1991 and 2003 with four of them being built in partnership with French companies².

Nuclear Power Comes of Age

It was not until a push by President Hu Jintao and his Prime Minister Wen Jiabao in 2003 that the country really began to invest in nuclear technology. In 2004, China launched a request for bids to establish the new Generation 3 standard for its electronuclear power fleet. It chose the AP1000 from the American company Westinghouse and construction of the first four reactors began in 2009-2010 at the Sanmen and Haiyang sites. At the same time, the French EPR was chosen for the Taishan unit 1 and 2 projects.

Thanks to a policy of localisation and technology transfer, some components of the AP1000 and the EPR are produced domestically. China's dependence on foreign technologies was reduced throughout the 2000s, with improved quality of its equipment and a mastery of expertise. Today, China controls the entire industrial supply chain for manufacturing the different parts of a power plant³.

Armed with these advances, the Chinese authorities decided to move towards a domestic reactor model. The China National Nuclear Corporation (CNNC) and the China General Nuclear Power Corporation (CGN), the two main state-owned businesses in the Chinese nuclear industry, took advantage of this to develop and bring their models up to standard, the ACP1000+ and the ACPRI000+ respectively, which were themselves derived from the French M310 reactor at Daya Bay.

After the Fukushima accident in 2011, China put its nuclear programme on hold. Its State Council suspended approvals for new power plants and declared that only Generation 3 reactors could be built. All new projects must meet higher safety standards, including dual pas-

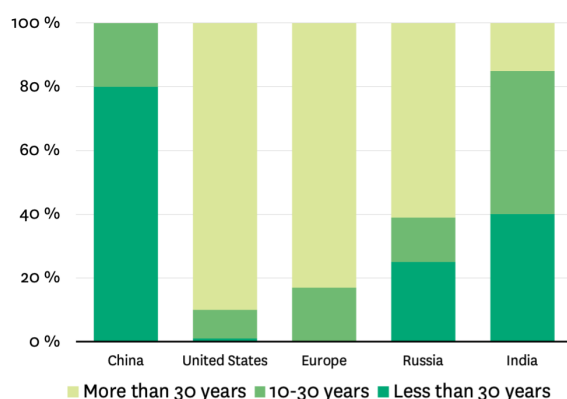
rale Nucléaire, n°5, September-October 2017.

2. PRIS, *Power Reactor Information System* (website), IAEA.

3. La Revue de l'Énergie, n° 624, March-April 2015.

sive and active reactor safety. To satisfy this requirement, in 2014 the government asked CGN and CNNC to merge their two reactor designs into a unified technology under the name Hualong One. The first plans for these reactors were approved and construction of Fuqing units 5 and 6 for CNNC and Fangchenggang units 3 and 4 for CGN began in 2015⁴.

FIGURE 1 • AGE PROFILE OF NUCLEAR POWER CAPACITY⁵



With forty-nine reactors currently in operation, nuclear power represents 4.9% of China's electricity mix. If the percentage of nuclear power seems low, it is important to put it into context: China is the world's largest producer of electricity. According to data from the International Energy Agency, in 2019, electricity production in France was 537.7 TWh, compared to 7140 TWh for China in the same year. Electricity produced solely by nuclear power in China therefore accounted for about 65% of France's total electricity production in 2019.

Unlike France, whose electricity mix is 70% nuclear, China has not chosen to make this its main energy resource. As the country has significant access to coal, an abundant and inexpensive resource, there was no real incentive in the previous decade to move towards cleaner energy. The challenge of climate change is now pushing China to begin its transition by diversifying its energy mix through solar and wind energy, whose prices have dropped considerably in recent years. Despite coal still comprising a major share of the electricity mix (around 60%), the objectives announced by Xi Jinping to reach peak CO₂ emissions in 2030 and carbon neutrality in 2060⁶ ensure that nuclear energy will have a permanent place in China's future electricity mix.

Unveiled in March 2021, the 14th Five-Year Plan (2021-2025)⁷ plans for 70 GW of installed nuclear power capacity in operation by 2025. Therefore, an additional 19 GW

must be connected to the grid, i.e. the construction of four reactors per year over the next five years. Despite halting inland power plant projects along rivers⁸, China is not making a risky gamble; the country already has twelve units under construction, more than half of the reactors it needs to reach its target.

Outlook: China's Nuclear Industry Seeks Autonomy and Internationalisation

During the two sessions of the National People's Congress held in March 2021, nuclear energy was designated as an indispensable tool for building "a modern energy system"⁹ where third- or fourth-generation power plants will have a role to play in the electricity sector and beyond (production of urban heating, hydrogen, etc).

To achieve its objectives, China wants to close its nuclear cycle and control its entire industry. On the one hand, it is securing its uranium supply by buying up mines in Africa and producing its fuel in its own plants in Inner Mongolia and Sichuan. On the other hand, it is creating storage sites for low-level radioactive waste and wants to invest in a reprocessing plant. The Chinese authorities are again looking to France, this time to recycle uranium and plutonium into mixed fuels (called MOX), thanks to a facility modelled on Orano's MELOX plant in Marcoule¹⁰.

In order to solidify nuclear energy's place within a legal framework and to manage a policy that safeguards the country's needs, two laws are being prepared. The first one, on atomic energy, is essential to frame and promote the development of nuclear energy. The second law in preparation, "Regulation on the Management of Spent Nuclear Fuel", is in line with the objective of closing the cycle and the "efficient and organized"¹¹ treatment of spent fuel.

A significant budget is allocated to controlling the back end of the cycle, as well as to research on Generation 4 reactors. Fast neutron reactors (FNR), small modular reactors (SMR), and fusion reactors are all research projects in which China is investing on a large scale. Today there are eight SMR projects, five of which are particularly far along¹². In addition to providing electricity production in isolated locations, China sees this technology as a way to

4. "China successfully develops first Hualong One nuclear reactor", China Daily, November 2017.

5. Source : IEA, 2019.

6. Xi Jinping's speech to the UN on 22 September 2020.

7. 14th Five-Year Plan, Tsinghua University, 2021.

8. Since Fukushima, the government has indefinitely frozen plans for riverside power plants in the face of public opposition and concerns about river pollution and water use during droughts. The 14th Plan again rules out the resumption of these projects for the next five years, J. Timperley, "Will China Gamble on a Nuclear Future ?", Energy Monitor, March 2021.

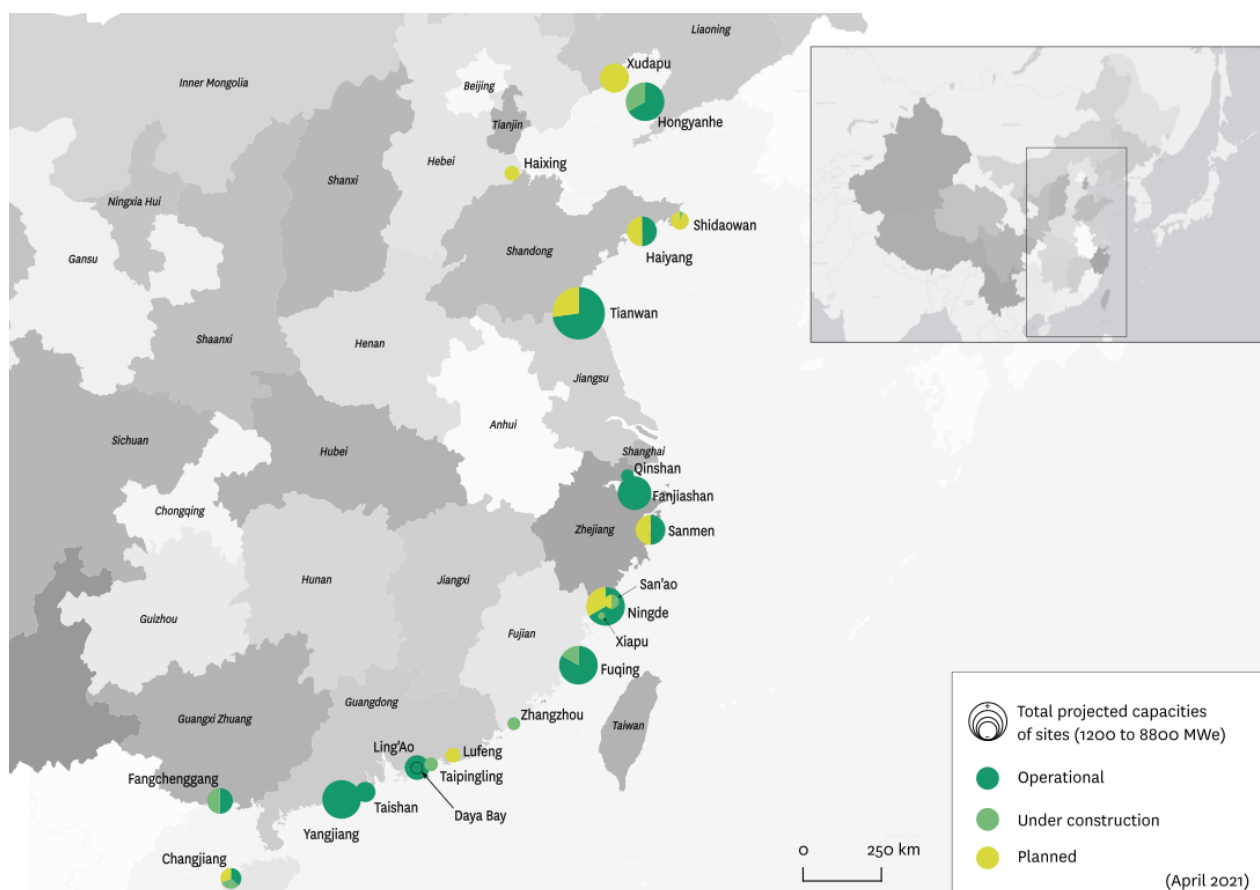
9. Interview with Gu Jun, Director General of the CNNC and Deputy Party Secretary for the Chinese news website Toutiao : "两会核声 | 顾军：中核集团将为碳达峰碳中和目标提供有力支撑", Toutiao, March 2021.

10. S. Huet, "Nucléaire : les ambitions chinoises", {Sciences}, Le Monde, June 2019.

11. Ibid.

12. *Advances in Small Modular Reactor Technology Developments. A Supplement to IAEA Advanced Reactors Information System (ARIS) 2020 Edition*, International Atomic Energy Agency, September 2020

FIGURE 2 • LOCATIONS OF CHINESE NUCLEAR POWER PLANTS



Operating reactors

Technology

Qinshan I	CNP300: the first PWR developed by a Chinese actor (CNNC).
Daya Bay 1, 2 Ling Ao 1, 2	M310: French technology "3-loop PWR" built by Framatome and Spie.
Ling Ao 3, 4 Ningde 1 - 4 Hongyanhe 1 - 4 Yangjiang 1 - 6 Fangchenggang 1, 2	CPR1000: Generation 2 PWR developed by CGNPC based on the French M310 design.
Qinshan II, 1 - 4 Changjiang 1, 2	CNP600: Generation 2 PWR based on the CNP300.
Qinshan III 1, 2	CANDU: Canadian pressurised heavy water reactor.
Tianwan 1 - 4	VVER: Russian technology PWR.
Tianwan 5	ACPR1000: the second version of the CPR1000, no longer uses components covered by the industrial property rights of foreign companies.
Fuqing 1 - 4 Fanjiashan 1, 2	CNP1000.
Fuqing 5 Hualong 1	Chinese PWR developed by CGNP, in particular on the basis of the ACPR1000.
Sanmen 1, 2 Haiyang 1, 2	AP1000: Generation 3 PWR developed by the American company Westinghouse.
Taishan 1, 2	EPR: French-made Generation 3 European PWR developed by Framatome, EDF and Siemens.

export these small reactors to countries that are newcomers to the civil nuclear market.

However, China is not losing sight of the advantages of higher power reactors. The domestic Hualong has become the standard technology for Chinese nuclear reactors. With sixteen Hualong One reactors under construction or planned in the country (ranging in power from 1080 to 1200 MWe), and two more under construction in Pakistan, China should benefit from the effect of mass-production allowing it to reduce even further the cost of its 100% Chinese reactor. Moreover, it has managed the feat of building its first Generation 3 reactor in just 68 months (between breaking ground and the start of commercial operation in January 2021).

To take advantage of these effects, the country is seeking to export its model. Despite a first contract with Pakistan for two units at the Karachi nuclear power plant (whose first one is expected to come on line in late April 2021), China is struggling to internationalise its reactor technology. To date, the Hualong reactor has also been proposed to the Czech Republic, Poland, Kenya, and Argentina, but without success.

The plan to build a Hualong-1 at the UK's Bradwell site could give China the credibility it is looking for¹³.

13. "Le Hualong-1 franchit une nouvelle étape au Royaume-Uni", Revue Générale du Nucléaire, January 2019.

The Hualong-1 must first pass the Generic Design Assessment (GDA), the certification issued by the UK nuclear safety authority. The National Nuclear Safety Administration (NNSA), the Chinese body in charge of nuclear safety, collaborates with other safety bodies of the major nuclear countries; this is the case with the Nuclear Regulatory Commission in the United States and the Agence de Sûreté Nucléaire (ASN) in France. China is also an ac-

tive member of the International Atomic Energy Agency (IAEA), which sets common standards for the nuclear industry. The issuing of a GDA certification for the Hualong-1 and the subsequent construction of one of these 100% Chinese reactors would be a very important measure of credibility for China and would enable it to establish itself as a nuclear power exportation country alongside Russia, Korea, France, and the United States.

Understanding the New Silk Roads of Energy

The origins and structuring of the New Silk Roads

When he came to power in 2013, the new Chinese President, Xi Jinping, wanted to benefit from the “pivot towards Asia” policy launched by Barack Obama and take advantage of the economic slump which the West had been in since the 2008 crisis. Incorporating some of the ideas of the academic Wang Jisi (“westward momentum” strategy 西进¹) and the strategies of the Ministry of Foreign Affairs, the Chinese President developed a three-fold plan: to strengthen ties between Beijing and its immediate neighbors in order to bring peace to the borders and push American influence out of Asia; to provide outlets for Chinese businesses that had become oversupplied due to the economic slowdown (the domestic market could no longer absorb all of China’s production); and to secure the many strategic routes to and from China while rebalancing the country’s development. The New Silk Roads initiative was born.

The plan was officially announced in September 2013 during a speech delivered in Noursoultan (formerly Astana, Kazakhstan). Invoking the spirit of the ancient caravans which once crossed Central Asia by camel, President Xi proposed a strategic partnership between China, Kazakhstan, Kyrgyzstan, and Uzbekistan, consisting of major investments in roads, railways, gas, oil, and electricity. Barely a month later, President Xi gave the initiative’s second major speech at the Indonesian House of Representatives in which he proposed strengthening the partnership between China and ASEAN² and spoke of building a “Maritime Silk Road for the 21st Century”. But it was not until

March 2015 that the National Development and Reform Commission published materials on the initiative, particularly emphasizing the “win-win” policy promoted by the initiative, which now has an official name: One Belt, One Road (一带一路). In other words, it refers to a land belt (Astana speech) and a sea route (Jakarta speech). This name was quickly abandoned and replaced by Belt and Road Initiative (BRI) because the first formulation could suggest that there would be only one road, whereas the project envisions an entire network.

The goal of the New Silk Roads, which is still misunderstood but which is nevertheless fundamental, is to breathe new life into China’s western provinces, which have largely been left out of the country’s development and which are experiencing a growing number of difficulties³. Xinjiang, for example, is set to become a major energy hub and corridor, serving as a gateway for hydrocarbons from Central Asia. Situated 3,000 km from Beijing, Xinjiang covers an area of 1.6 million km² and is made up of vast desert basins bordered by high mountains. Historically, this region was not part of the Han sphere of influence (its inhabitants are Turkish-speaking Uighurs) and was only integrated into China in 1769, from where it gets its name of Xinjiang, which means “New Frontier. Beijing has been trying to open up and introduce the region into global flows, first through the “Western Development Strategy” (西部大开发) and more recently with the New Silk Roads. If we focus only on the energy aspect, Xinjiang can even be considered as the cornerstone of the BRI. This explains why the Communist government is so anxious about the Uyghurs seeking greater autonomy and its brutal response to ensure the stability of the region in the medium term through forced sinicization, sterilization, and the establishment of a concentration camp system.

Faced with such a sprawling initiative, financing is met through several entities⁴:

- The sovereign wealth fund Silk Road Fund (丝路基金), originally endowed with \$40 billion in 2015 to which \$10 billion was added in 2017;
- Loans from Chinese strategic banks: China Development Bank (\$32 billion), the Export-Import Bank of China (\$30 billion), the Agricultural Development Bank of China;
- The Asian Infrastructure Investment Bank (AIIB), endowed with around \$100 billion, which was created as a multilateral development bank to complement the World Bank but controlled by China;
- The New Development Bank with about \$100 billion in capital which finances infrastructure projects in developing countries;

1. J. Wang, “Westward, China’s Own Geostrategic Rebalancing”, Global Times, October 2012.

2. Association of Southeast Asian Nations with ten countries: Malaysia, Singapore, Thailand, the Philippines, Brunei, Vietnam, Laos, Myanmar, and Cambodia.

3. E. De la Maisonneuve, “Une ceinture, une route ; ou le versant chinois de la mondialisation”, Revue Défense Nationale, 2018.

4. C. Vicenty, “Les Nouvelles routes de la soie : ambitions chinoises et réalités géopolitiques”, Géoéconomie, 2016.

- Loans from the National Bank of China (\$62 billion).

This financing is meant to provide the necessary resources to create or revitalize roads throughout the world.

The initiative's geography and influence

The New Silk Roads is a vast network which stretches across Eurasia with branches in Africa, America, and even the Arctic. Because China regularly changes the routes that are part of the project, adding and removing them according to its political agenda, it is difficult to accurately list them. Recently, we have even seen countries leave the project, such as Australia did on 21 April 2021, at a time when relations between Beijing and Canberra are at an all-time low. The island-continent is seeking to rid itself of Chinese influence that has been deemed to be problematic due to the corruption of parliamentarians and concerns of espionage⁵. Nevertheless, we can highlight some of the main routes which are of crucial importance to Beijing. The Xi'an - Duisburg route partially following the path of the ancient roads and passes through Urumqi, Horgos, Almaty, Bishkek, Samarkand, Buchanbe, Tehran, and Istanbul, carrying raw materials and energy to China as well as manufactured products destined for Europe. There are many branches throughout Central Asia (the real heart of the Chinese project, both to secure its energy supply and to increase its influence and disseminate its model), in Russia (including the secondary Beijing-Europe route which passes through Ulanbaatar, Irkutsk, and Moscow), in Pakistan (the highly strategic corridor between Gwadar and Xinjiang), as well as in South Asian countries sympathetic to China (Bangladesh, Myanmar, Laos, Cambodia, etc.) In terms of maritime routes, the Venice-Shanghai corridor is the cornerstone of the initiative and includes Athens, Djibouti, Gwadar, Hambantota. This route has a branch at Gwadar for the Persian Gulf and its considerable energy resources. Other secondary routes lead to Chittagong (Bangladesh), Kyaoukpyu (Myanmar), and even to Nairobi (Kenya) and Caracas (Venezuela). More surprisingly, in order to no longer be dependent on the narrow Malacca Strait, China is planning to create a new route (canal) through the Kra Peninsula (Thailand).

Within China's borders, all these land routes lead, as we have briefly mentioned, to the Xinjiang Autonomous Region. Sharing its borders with eight countries – Afghanistan, Kazakhstan, Kyrgyzstan, India, Mongolia, Pakistan, Russia, and Tajikistan – the region's geographic location makes it the ideal gateway for Chinese influence in Central Asia. Since the 1990s, China has built multiple border crossings to promote trade, particularly at the Alatau Pass (or Dzungarian Gate); on the Kazakhstan border, the city of Alashankou became the largest dry port in China for

the movement of international freight in 2010, thanks to the linking of the Chinese and Kazakh rail networks. The “dual cities” of Xinjiang are an essential link in China's strategy to encourage trade – Horgos (China)/Khorgos (Kazakhstan), a major road transit point, is one example.

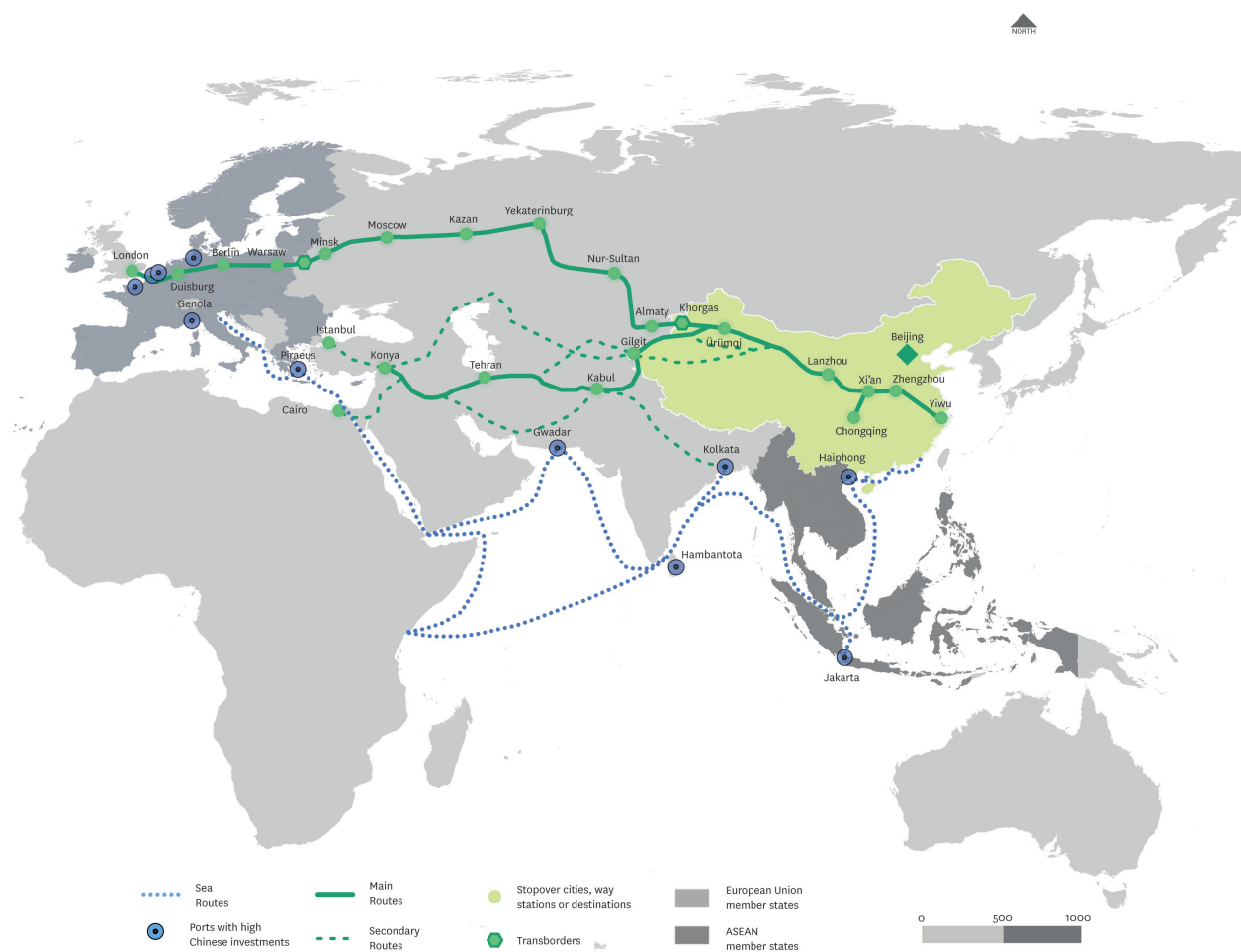
The goal of these new corridors is clear: to redefine the world order through the BRI, which involves the creation of a kind of “strand of pearls”⁶ across the globe, consisting of a series of home ports (maritime or dry) in order to secure supplies for China and to allow the Chinese navy, the People's Liberation Army, or Chinese companies and businessmen to benefit from “forward bases” along the main trade routes. In order to not alarm its partners, the Chinese government delegates the construction of this string of infrastructure projects to large, state-owned companies (the Chinese state itself does not appear) such as the China Communications Construction Company (CCCC), which have immense resources.

Between 2013 and 2015, around sixty countries were involved in the New Silk Roads initiative; in 2020, there were nearly 130. China's ambition is to bring as many countries as possible into its initiative, but there are several which are key links in this chain. Let us look at three. Pakistan has received special attention from the People's Republic, which allocated \$46 billion in 2015 to create an economic corridor between the port of Gwadar and Kashgar. This is where the Karakoram road starts, crossing the mountain range of the same name and leading into China (Xinjiang). Gwadar is strategic in more ways than one. As it is surrounded by deep waters, all types of ships can dock there. The presence of a Pakistani military base grants China a certain stability and could eventually allow the People's Liberation Army to set up an outpost there. Finally, Gwadar's proximity to the Gulf of Oman makes it an ideal port of entry to bring hydrocarbons from the Middle East into China, especially since China now has a presence in Djibouti. A terminal for gas tankers will allow gas to be imported from Qatar and the liquification of gas from Iran; a refinery combined with an oil pipeline will send the crude to Xinjiang. The New Silk Roads initiative also allows Pakistan to find financing solutions for thermal power stations at a time when western banks are becoming increasingly hesitant to invest in these projects, especially if they include coal. China is much less discriminating, as evidenced by the consortium formed by China Huaneng Group and Shandong Ruyi, which will operate the highly profitable Sahiwal power plant for the next 30 years and which provided 20% of the needed capital (\$355 million) with the remaining \$1.4 billion loaned to Pakistan by the Industrial and Commercial Bank of China. Finally, Pakistan is India's nemesis, itself a regional rival of China's. Maintaining good relations with Islamabad allows Beijing to increase pressure on New Delhi.

5. E. Véron, E. Lincot, “L'Australie face à la Chine : la montée des tensions”, The conversation, March 2021.

6. K. Merigot Kevin, “‘Collier de perles’ et bases à usage logistique dual”, Geostrategia, February 2019.

FIGURE 1 • MAP OF THE NEW SILK ROADS OF ENERGY



After Pakistan, Myanmar is a second Chinese source of energy supply security while also being near India. The opening of a corridor between the port of Sittwe and Kunming (Yunnan) for transporting oil helps to diversify China's energy routes. Beijing has also established a presence on the Coco Islands, building a communications interception station in 1992 to monitor maritime traffic while being in close proximity to India, whose Andaman Islands are only about 20 km away. A military port project is being studied on Little Coco Island, while on the mainland, the port of Kyaukpyu has been expanded by Chinese capital and privatized. The recent turmoil in Myanmar is being closely monitored by China – a military victory and a return to dictatorship would allow Beijing to regain control of the country by brushing aside the influence of the United States and Japan, which had grown stronger during the democratic period.

Due to its great hydrocarbon resources, Kazakhstan accounts for more than 70% of Chinese investments in Central Asia⁷. Kazakhstan's economy is based mainly on exporting gas and oil, of which it has 3% of the world's resources, as well as uranium, which accounts for 12% of the world's resources, with production of 19,500 tons

in 2020. Several oil and gas pipelines run through this immense country of 2.7 million km², whose population is only 19 million. These pipelines run from Beyneu on the Caspian Sea to Horgos on the Chinese border (gas pipeline), and from Atyrau in the west of the country to Karagandy in the center and Alashankou near Xinjiang.

An initiative which serves Chinese energy security

Despite its vast size, China is a country with relatively few oil and gas resources, with the exception of a few oil and gas wells in Xinjiang (Dzungary and Taklamakan). It does, however, have abundant coal deposits, the largest of which are located far from urban centers in Xinjiang, Shanxi, and Inner Mongolia. The strong economic growth that has characterized the country for several decades has been accompanied by a sharp increase in energy demand which has been reinforced by prices that have been kept artificially low to encourage consumption. This demand could only be met through a policy of aggressive coal mining, which has made it the primary source of electricity in China for decades. However, domestic production was quickly unable to keep up and since 2009 Beijing has had to import coal on a massive scale (304 million tons by

7. A. Cariou Alain, "Les corridors centrasiatiques des Nouvelles routes de la soie : un nouveau destin continental pour la Chine", L'Espace géographique, 2018.

2020⁸), exposing the country to the threat of a sudden change in prices or a breakdown in trade relations. In the Middle Kingdom itself, the economic model of mining is running out of steam – “mini-mines” in disadvantaged areas are now used to buy social appeasement, even though their productivity is very low and their ecological impact immense⁹. At the opposite end of the spectrum, state-owned enterprises are generally giant technostuctures with low yields (excessive labor, debt ratio that is too high). The massive use of lignite is also having disastrous health consequences. In 2016, only 2% of the Chinese population breathed air that complied with WHO recommendations, largely because of coal usage. Faced with this problem, the Chinese Communist Party (CCP) is aggressively developing alternative energies (renewable and nuclear) but has been unable to significantly reduce the proportion of fossil fuels which represented 78.5% of China’s electrical mix in 2008 and was still at 70.3% in 2018¹⁰ (at the same time, consumption of fossil fuels has seen a three-fold increase, from 11,119 TWh to 33,512 TWh).

The Communist regime’s continued existence, based on the social pact of “stability and wealth for submission and loyalty” – which dates to the era of Deng Xiaoping’s economic reforms (1978-1992) and are a contemporary manifestation of the ancient “Mandate from Heaven” (天命 the belief that the government’s legitimacy comes from its ability to ensure the wealth and security of its people) – depends on maintaining strong growth. In its quest for survival, the Party spares no expense and must generate considerable energy in order to maintain energy-intensive industries (cement plants, steel mills, glass factories, etc.) to produce growth. This explains the proliferation of excessive and often irrational infrastructure projects. In addition, China has a particularly high energy intensity, although it is constantly falling: 0.79 in 1980; 0.23 in 2000; 0.13 in 2019. For comparison, Japan’s energy intensity was 0.08 and India’s was 0.09 in 2019¹¹.

Ensuring a constant energy supply for Chinese industries, which are the drivers of growth, is therefore of utmost importance to Beijing. While the pharaonic New Silk Roads initiative is generally presented as a means of providing outlets for China’s overproduction, its geostrategic dimension in the field of energy is of vital importance to China.

It is particularly crucial for China to secure these routes because current ones depend on choke points that could be used as leverage to apply pressure. This is especially true of the tricky passage through the Strait of Malacca¹², an area plagued by piracy and which gives si-

gnificant leeway to the city-state of Singapore, which is on good terms with the United States¹³. In the event of a conflict with America, a blockade of Malaysia and the Sunda Strait could totally paralyze China. China therefore has every intention of diversifying the origins of its energy resources and increasing its number of trade corridors.

China has also been wooing oil-producing countries, primarily Iran and Venezuela, with the latter settling its debts to China directly in black gold. The China National Petroleum Corporation (CNPC, 中国石油天然气集团公司) and the China National Offshore Oil Corporation (CNOOC) have numerous interests in this South American country, and the route remains open despite U.S. sanctions. In the Central Asian region, in addition to railroads and highways, it is above all energy imports that play a key role. More than anything, Beijing wants to secure an oil pipeline that runs from Atasu (Kazakhstan) to Alashankou in China. A crucial piece of infrastructure is already in place in Horgos (Xinjiang) - a gas pipeline that links Turkmenistan to Shanghai and allows China to receive 55 billion cubic meters of natural gas from Turkmenistan, Uzbekistan, and Kazakhstan every year. This energy route is therefore spreading to the four corners of Central Asia, and with it the powerful CNPC, which has taken a leading role in oil extraction not only in Kazakhstan (Atyrau, Mangystau, Kyzylorda, Darkhan), but also in Turkmenistan (which allowed China to control a quarter of its gas production in 2015), and Uzbekistan. The resulting energy corridor is 9,000 km long, running from the Caspian Sea to the Chinese coast. But beyond fossil resources, China has been increasingly focused on the atom and Beijing has now cornered a part of Kazakhstan’s rich uranium deposits. In 2014, China General Nuclear (CGN) signed agreements with KazAtomProm to extract and enrich uranium in Kazakhstan and more than half of the Kazakh national company’s production has subsequently been exported to China. In December 2015, the two countries announced the creation of a \$2 billion fund to carry out bilateral projects as part of the New Silk Roads, including the Ulba-FA nuclear fuel production plant (a joint venture between KazAtomProm and CGN), whose construction began in 2016 and was completed in 2020.

The place of renewable and alternative energies

Alternative energies such as nuclear and renewables have a place in China’s BRI strategy, but in a different form than fossil resources. First and foremost, China needed the missing renewable and nuclear technologies. A great scientific power for many centuries, China has experienced a long period of stagnation in the modern era¹⁴. Reforms made starting in the 1970s were not only

8. X. Muyu, S. Shivani, “China’s coal consumption seen rising in 2021, imports steady”, Reuters, March 2021.

9. G. Michel, “Chine : l’énergie, un enjeu stratégique”, Politique étrangère, 2018.

10. “China’s energy market in 2018”, BP Statistical Review – 2019.

11. IEA Atlas of Energy, IEA website, energy intensity in 2015 US dollars.

12. E. Puig, “Belt and Road Initiative, ou les habits neufs de la stratégie chinoise”,

Revue Défense nationale, 2018.

13. Links strengthened by the Free Trade Agreement between the two countries and the annual Strategic Partnership Dialogue.

14. This is the “Needham question”, from the famous English sinologist of the same name, who tried to understand why China had not experienced the

aimed at increasing China's economic power but also at obtaining official technologies so that the Middle Kingdom could catch up and eventually regain its leadership status. The requirement that foreign companies wishing to set up operations in China must establish a joint venture with a Chinese partner is one of the measures imposed in many sectors that has led to a massive strengthening of China's role in the innovation market. President Hu Jintao (with his Prime Minister Wen Jiabao) was the first to pursue a national innovation policy (自主创新) which was then taken up by Xi Jinping's government with the Made in China 2025 plan (中国制造2025). A "Nuclear Silk Road" was set up as early as the 1980s to provide the country with reactors: AECL (Canada), Atomstroyexport (Russia), Framatome (France), and Westinghouse (United States) were all involved, enabling the country to have a large fleet of 49 reactors (47.8 GWe¹⁵) by January 2020, with another 16 under construction. Following the success of this strategy, in the early 2010s, the People's Republic launched an ambitious domestic program that culminated in the January 30, 2021 launch of Hualong-1, a third-generation pressurized water reactor. In order to close the nuclear fuel circle, China hopes to build a reprocessing plant on its soil, again through technology transfer; discussions with France are underway. With its expertise in nuclear technology, China has begun exporting the Hualong-1 reactor along the Silk Roads with two under construction in Pakistan and negotiations underway with Romania, Iran, Turkey, and Kenya.

For decades now, health concerns have largely been overlooked in China. However, the current energy-intensive model, supported by highly subsidized electricity to promote growth, seems to have reached its limits. On the one hand, this is due to changing public opinion, which is tired of living in perpetual smog, and on the other hand, it is difficult to sustain the upward evolution of China's industry and its innovation. This is especially true of the "export" aspect of the BRI, which is directed at Europe at the far end of the New Silk Road. Since signing the Paris Agreement in June 2017, and even more so after the American withdrawal, China has considered itself to be an environmental champion. In addition to increasing China's market share in a booming industry with very high added value, this stance is designed to force the West to make a choice between respecting human rights and reducing Chinese greenhouse gas emissions. The idea of encouraging a "green" BRI is gaining ground (Belt and Road Ecological and Environmental Plan, 2017), allowing China to promote its low-carbon technologies for export in the medium term.

And yet, China has a powerful asset that could lead it to becoming the leading export power of low-carbon technologies along the New Silk Roads: its giant rare earth

minerals industry (90% of global production in 2016) and the capability to process them domestically (75% of global demand)¹⁶. The turning point for China came in 1995, when the American permanent magnet producer Magna-quench was bought out by the investment fund Sextant, itself owned by San Huan New Material and the China National Non-Ferrous Metals Import and Export Corporation, headed by two of Deng Xiaoping's sons-in-law. The technology for manufacturing fine granules of magnets from rare earth minerals, which are essential for the production of wind turbines and electric vehicles, was thus repatriated to China along with all the assets of Magna-quench. With the Renewable Energy Promotion Law of 2003 and the Renewable Energy Law of 2005, Beijing has sought to create a favorable domestic environment for renewable energy research, with a threefold objective: to reduce dependence on energy imports, to develop domestic renewable energy industries, and, above all, to launch an overseas-oriented trade policy. The state-owned Xiangtan Electric Manufacturing Corporation (XEMC), financially supported by Beijing and benefiting from comparative advantages beyond the reach of its competitors with preferential access to rare minerals and low labor costs, has been increasing its joint ventures since 2012 in Finland, Japan, the Netherlands, and Germany. In general, Chinese clean-tech companies receive considerable support; in 2015, they attracted \$34.6 billion in private funding, twice as much as in the United States¹⁷. China has succeeded in creating international leaders in the high-value-added environmental sector, in wind power, batteries, and photovoltaics. Now that the market is developed, the Silk Roads are destined to become conduits for "green" energy flows from China to the rest of the world. Among the energy projects currently under development, Pakistan claims the lion's share: more than a dozen projects are underway, including renewable power plants such as the HydroChina Dawood Wind Power Project east of Karachi, at a cost of \$115 million, funded by the Industrial and Commercial Bank of China.

The initiative's political difficulties

Despite its obvious strengths and the unwavering support of the Beijing government, the New Silk Roads project has many weaknesses that have the potential to undermine the entire Chinese strategy. The first, and no doubt most dangerous, is China itself, or rather its diplomatic personnel and the version of the country portrayed on the international stage. Since Xi Jinping came to power, China's traditional diplomatic restraint has taken a completely different direction, known as "wolf warrior diplomacy". In order to be seen as valuable by the central power, Chinese diplomats compete to demonstrate

industrial revolution and lost its global technological leadership.

15. For comparison, in France: 63,2 GWe.

16. E. Lanckriet, J. Ruet " *La longue marche des nouvelles technologies dites 'environnementales' de la Chine : capitalisme d'État, avantage comparatifs construits et émergence d'une industrie* ", Annales des Mines – Gérer et comprendre, 2019.

17. Ibid.

their nationalism in the hope of promotion and no longer hesitate to attack, in an extremely aggressive manner, any figure or institution that would criticize the People's Republic. Although this is a domestic political strategy designed to pander to the unbridled nationalism of the Chinese population, the consequences abroad are very damaging for Beijing. As a poll conducted by Pew Research in 14 countries shows, 74% of respondents have a negative view of the People's Republic of China¹⁸, and Western public opinion overwhelmingly rejects China. Moreover, the consequences of this diplomacy can also be seen in China itself. For instance, Australia, which has publicly requested an impartial investigation into the origins of the Sars-cov-2 virus, has suffered the wrath of the wolf warriors. China retaliated by stopping the import of Australian coal, causing power cuts in winter when production could not meet demand. As a result, China was forced to increase imports from Pakistan. However, Islamabad did not have the capacity to meet Chinese demands, so the country imported coal above market price... from Australia! China itself was responsible for the disruption of its supply¹⁹. But beyond this example, growing distrust of China in the Western world could undermine the very purpose of the Silk Roads for Energy, which is built in part, as we have seen, on the export of environmental technologies to Europe.

Losing sovereignty to China over parts of their territory is also a concern for emerging economies participating in the BRI. The Hambantota port in Sri Lanka is an excellent example of this. A critical maritime asset along the Pakistan-China route, it cost about \$350 million to build, funded almost exclusively by the Export-Import Bank of China. But its disproportionate size and inability to compete with the already thriving port of Colombo forced Sri Lanka to open debt restructuring negotiations with China, as profits were insufficient. Beijing wiped the slate clean in exchange for an exclusive concession of the port's 60 square kilometres of land for a 99-year lease, starting in July 2017. In Mombasa, Kenya's main port, the signing of an \$82 million contract with the China Road and Bridge Corporation in 2011 to expand the capacity of its docks has raised fears that the African country, which is already heavily in debt, will not be able to repay its commitments and will have to give up part of the port's resources and the highly strategic railway line between the maritime facilities and the capital Nairobi. As early as 2018, the International Monetary Fund warned against Chinese loans, as their interest rates of up to 7% are often unsustainable²⁰. Malaysian Prime Minister Mohamad Mahathir, seeing the Chinese trap, secured a cost reduction of about 33% for

a railroad and pipeline in his country, the East Coast Rail Link, from 65.5 billion ringgit to 44 billion ringgit (\$10.7 billion) after initially withdrawing from the project that his predecessor Najib Razak (2009-2018) had signed.

Europeans are divided on this issue. Both Greece, with Piraeus, and Italy, with the ports of Genoa and Trieste, are dependent on Chinese investment and have joined the BRI. Northern Europe, and Germany in particular, is wary of criticizing Beijing because of the dependence of its economies on exports to China. Cautious France was forced to break its silence after multiple orchestrated provocations by the Chinese Embassy in Paris²¹.

Finally, we must take into account what could be called the "sublime isolation of China". The Middle Kingdom dreams of being a hyperpower but has no powerful ally to build the New Silk Roads project with it. The country's relations with Russia are quite erratic; while both countries want to overthrow the international order they inherited from the Second World War and share a certain ideological similarity, they are also rivals in a large number of areas. This is especially true when it comes to their hold over Central Asia which is critical for China's energy survival, but has traditionally been beholden to Moscow. In 2015, Russia had launched its own project, the Eurasian Economic Union (EEU), comprising Russia, Belarus, Kazakhstan, Armenia, and Kyrgyzstan, before Vladimir Putin announced that this union would join the New Silk Roads. Behind its seeming adherence to the BRI project, Russia is acting underhandedly to maintain its influence, for example by proposing to China that Moscow be the guardian of the security and stability of Central Asia. It should also be noted that relatively few countries share a real ideological affinity with China – Vietnam cut some of its ties with its powerful neighbor after its invasion of Democratic Kampuchea in 1978-79 and the subsequent China-Vietnam war (1979). It is worth mentioning that Vietnam is not interested in the BRI and does not wish to seek Chinese loans. North Korea, on the other hand, is seen as an unpredictable but indispensable protectorate to secure the northeastern border of the People's Republic. If its coal mines are used to feed the Chinese energy program, the extreme weakness of its production and its infrastructure make it only a last rank trade partner – China represents 83% of North Korean exports but only \$2.8 billion. For the record, North Korea's GDP is estimated at \$29 billion, which represents 1.5% of its southern neighbor's GDP. Lastly, Venezuela is engulfed in a severe economic crisis and seems to be surviving only with China's help, who is taking advantage of the situation to demand nearly 500,000 barrels of oil per day (about

18. L. Silver, K. Delvin, C. Huang, "Unfavorable Views of China Reach Historic Highs in Many Countries", Pew Research Center, October 2020.

19. "Les conséquences de l'embargo chinois sur le charbon australien", Transitions et Énergies, December 2020.

20. Ms. Lagarde's speech in Beijing at the New Silk Roads forum in April 2018. See also Maureau Florine, "Le piège de la dette chinoise se referme sur les intérêts français", Intelligence Économique, March 25th 2021

21. Among others, pressure on exhibitions in France (Kerviel Sylvie, "Une exposition sur Gengis Khan au Musée d'histoire de Nantes censurée par la Chine", Le Monde, October 13th 2020) or insults to a French researcher (Seibt Sébastien, "Quand l'ambassade de Chine se déchaine contre un chercheur français", France 24, March 22th 2021).

5% of Chinese imports of black gold in 2017)²². Other states having affinities with China are above all driven by strictly economic, national, or personal interests. The recent shifts in the alliances of the Solomon Islands and Kiribati, which broke off diplomatic relations with the Republic of China (Taiwan) to recognize the People's Republic, were motivated by Beijing's largesse and have little to do with China's development model. While China may be getting stronger, it is not managing to generate support and its soft power remains very weak. Despite all of President Xi's efforts, the "Chinese dream" is having trouble scaling the Great Wall.

Once more in this initiative, China is its own worst enemy. The heaviness of the Communist Party and its bureaucratic organization of "cliques" fighting each other impedes rational decision making²³. The hunt for political enemies, under the hypocritical pretext of fighting corruption, leads to instability in key ministries. Above all, appointments are now made based on loyalty to Xi rather than on qualifications.

Companies – which are officially private but are in reality supported by the state – that invest along these energy routes are anxious to receive public subsidies. They are eager to throw themselves into various projects in order to be well-regarded in Beijing, even if it means defying rules of good management. The New Silk Roads, and especially their energy component, require a great deal of capital. Building ports, oil pipelines, or refineries takes a great deal of financing. The necessary investments are estimated to be between \$4,000 billion and \$26,000 billion²⁴, which is twice China's GDP at its highest estimate. Beijing's attempts at attracting foreign investors are mostly met with polite refusal as enormous infrastructure projects are not highly profitable, the countries targeted are often unstable, and China is cloaked in proverbial secrecy. Western, as well as Asian, elites are in no rush to invest. A first slowdown in BRI financing can already be seen in calculations by RWR Advisory²⁵, which showed that from \$150 billion in annual lending in 2014-2015, the figure had dropped below \$100 billion in 2017 and 2018.

The initiative's lack of clarity is also a major hurdle for potential partners. Since 2013, the BRI has changed its focus several times with new routes being added or removed depending on the political, economic, or social landscape and the moment's ideological needs. The control of information and, more seriously, its changeability, led

countries such as Germany and France to refuse signing the final statement of the Belt and Road forum in 2017 due to its critical lack of specifics.

Japan, a traditional ally of the United States who maintains good relations with India but whose relationship with China is not always easy, has expressed its opposition to the New Silk Roads. In 2015, Tokyo unveiled its Indo-Pacific strategy in partnership with the Asian Development Bank based on liberal values which it calls "Partnership for Quality Infrastructure" (PQI) which is endowed with \$110 billion. As with the BRI, the heart of the project is its energy component. Tokyo hopes that Japanese companies, through public-private partnerships in Asian and African countries, will increase their electrical production capacity to 2,000 MW by 2023, mainly in geothermal energy. The PQI rests on five principles: effective leadership, economic efficiency, job creation, strengthening capacity for the transfer of expertise and skills, and managing the social and environmental impacts of these infrastructure projects. By 2019, the project's funds had nearly doubled to \$200 billion²⁶. Japan highlights the high quality of its technological expertise and infrastructure to set itself apart from a still unappealing "Made in China". It is implicitly criticizing an imperialist and aggressive China whereas it values cooperation and the respect of liberal values. And so, in 2017, Prime Ministers Abe (Japan) and Modi (India) inaugurated the first high speed rail line in India which was 80% financed by Japan. These two Asian giants also teamed up in the "Asia-Africa Growth Corridor" (AAGC) which explicitly aims to act as a foil to the Chinese New Silk Roads and is supported by the United States. As with the Chinese example, securing energy supplies is critical, especially since Japan has drastically reduced the share of nuclear energy in its energy mix since 2011 and that, unlike its large neighbor, the island nation has no energy resources. India and Japan therefore aim to secure the Indo-Pacific coastline by first connecting the ports of Djibouti and Jamnagar (Gujarat), and from Mombasa and Zanzibar to Madura (Tamil Nadu). But the AAGC is still in its infancy and it is still hard to know if the project will truly be able to compete with and offer a liberal alternative to China's New Silk Roads.

In conclusion, the New Silk Roads of Energy initiative is critical to China's strategy of independence and growth. Beijing hopes to diversify its supply sources all while increasing its regional and global influence, including breaking the liberal model put in place following World War 2. China has many means for bringing this project to fruition, but there are very real challenges that must not be overlooked: costly financing, concerned partners, political blunders, and the implementation of opposing projects all greatly damage the New Silk Roads' rebirth.

22. M. Albert, C. Jude, "Venezuela : l'insoutenable du modèle de croissance, source de tous les risques", *Revue d'économie financière*, 2016, (data updated by the author).

23. A time-honored formula for distinguishing CCP factions, see for example A. Payette, "Chine : Xi Jinping 'président à vie' ? Peut-être, mais il devra négocier", *Asialyst*, April 2021 ; M. Finkelstein, M. Kivlehan, "China's leadership in the twenty-first century : the rise of the fourth generation", Routledge, 2002.

24. E. Mottet, F. Lasserre, "La Belt and Road Initiative, un projet viable ?", *Revue internationale et stratégique*, 2019.

25. *The Belt and Road Monitor* (website), RWR Advisory Group.

26. J. Babin, "La Stratégie Indo-Pacifique libre et ouverte, un contre-projet japonais aux Nouvelles routes de la soie ?", *Groupe d'études et de recherche sur l'Asie contemporaine*, September 2019.



Han Chen • Manager Energy Policy, International Program at Natural Resources Defence Council. Former researcher at the Brookings Institution

Cecilia Springer • Senior researcher, Global China Initiative at the Global Development Policy Center, Boston University

China's Uneven Regional Energy Investments

92

In the lead-up to the first Belt and Road forum in May 2017, China published its “Guidance on Promoting Green Belt and Road,” “Belt and Road Ecological and Environmental Cooperation Plan,” and “Vision and Actions on Energy Cooperation in Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road”, emphasizing that its investment projects will be used to promote the Paris Agreement and 2030 Sustainable Development Goals and are motivated by the need to “share the ecological civilization philosophy and achieve sustainable development.”

Despite official policy, China's Belt and Road Initiative (BRI) has come under continued criticism for promoting dependence on fossil fuels in developing nations and investing in environmentally damaging infrastructure projects. The BRI is heavily invested in global energy infrastructure. Within the energy sector, power generation is the largest destination for Chinese development finance, and of that, coal-fired power generation makes up the largest share¹. Fossil fuel-based power generation produces CO₂ emissions that contribute to climate change, as well as local air pollution that damages the health of communities near a given power plant.

The regional distribution of power plants with Chinese involvement is highly uneven, and the share of different fuel types also varies by region. Host country preferences play a major role in determining the types of electric power generation that are developed with Chinese partners, demonstrating a complex network of “supply push” and “demand pull” factors that ultimately deter-

mine fuel choice and technology quality for a given project².

In seeking to understand regional patterns in Chinese involvement with the global electric power generation sector, we first clarify types of Chinese involvement. Prior research has heavily focused on overseas development finance disbursed by China's state policy banks, the China Development Bank and the China Export-Import Bank. However, since a peak in 2016, Chinese overseas development finance for the energy sector has decreased over time³. In order to capture changing trends in how Chinese finance flows overseas, we also include data on China's foreign direct investment (FDI) in the power generation sector. We also track Chinese involvement via construction companies, such as those with Engineering, Procurement, and Construction (EPC) contracting arrangements, a growing channel for Chinese companies going overseas^{4,5}.

Assembling this novel dataset, we then explore regional patterns in Chinese involvement, as well as regional distribution of power generation capacity for different types of fuels receiving Chinese finance and investment. We focus on the patterns between fossil fuel generation and renewable energy, in the forms of coal and natural gas for fossil generation, and wind and solar for renewable energy. Our final dataset includes 1,027 coal, gas, wind, and solar plants representing 272 GW of capacity, including operational and planned plants between 2000 and 2033 (Figure 5). In this dataset, all plants involving a Chinese EPC arrangement are coal plants. Given that fossil fuel generation is inherently carbon intensive, while wind and solar are low carbon sources of electricity, we focus our discussion on case studies and policy recommendations that affect the incentives for Chinese developers of both categories of energy. We conclude with policy recommendations for China to achieve its stated aim of a green BRI that aligns with the Paris Agreement and the Sustainable Development Goals of China.

Main Findings

Shifting Trends in How China is Involved in Overseas Power Generation

Our dataset shows that, from 2000, there are a significant number of Chinese construction contractors going overseas to build coal plants, not necessarily financed

1. K.P. Gallagher et al., “China's Global Power Database”, Global Development Policy Center, Boston University, 2019 ; M. Muñoz Cabré et al., “Expanding Renewable Energy for Access and Development: the Role of Development Finance Institutions in Southern Africa”, Boston University, Global Development Policy Center, 2020 ; Z. Li et al., “China's global power: Estimating Chinese foreign direct investment in the electric power sector”, Energy Policy 136, 2020.

2. B. Kong, & P. K. Gallagher, “Inadequate demand and reluctant supply: The limits of Chinese official development finance for foreign renewable power”, Energy Research & Social Science 71, 2021.

3. X. Ma, K. Gallagher, S. Chen, “China's Global Energy Finance in the Era of Covid-19”, Boston University Global Development Policy Center. Global China Initiative Policy Brief, 2021.

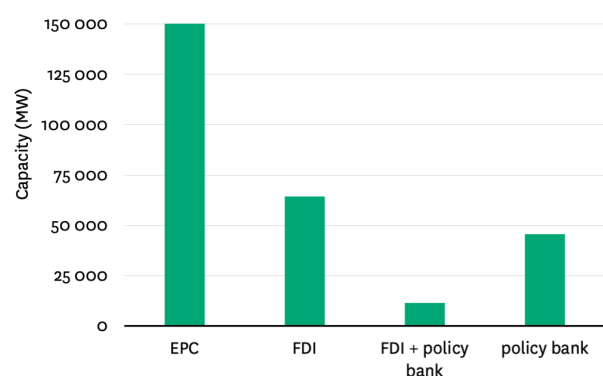
4. H. Zhang, “The Aid-Contracting Nexus: The Role of the International Contracting Industry in China's Overseas Development Engagements”. China Perspectives 17–27, 2020.

5. For a full discussion of our methods, see the last section of this article

by Chinese policy banks or FDI. In the coal sector alone, the capacity represented by these arrangements dwarfs Chinese policy bank finance and FDI for coal, gas, solar, and wind combined (Figure 1). Our dataset tracks construction arrangements without associated policy bank finance or FDI, although the plants with identified Chinese policy bank finance or FDI may also have Chinese construction contractors (that is, the capacity associated with Chinese construction companies should be seen as a minimum).

Breaking this down by region, we can see that policy bank finance for power generation and construction arrangements for coal are dominant in South and Southeast Asia, while Chinese FDI is distributed more evenly across regions.

FIGURE 1 • GLOBAL POWER PLANTS WITH DIFFERENT TYPES OF CHINESE INVOLVEMENT



It is interesting to note the outsize role that India represents in terms of Chinese construction arrangements for coal plants without associated development finance or FDI. We found a total of 150 GW of global coal capacity with Chinese construction contractors; 49 GW of this, or 33% of the total, was in India alone. This likely reflects the complicated relationship between India and China. The Indian government imposed import duties on power equipment in 2012, reducing Chinese participation in the coal power sector in India⁶. However, it is clear that Chinese construction contractors have a strong presence in India's coal plant development market.

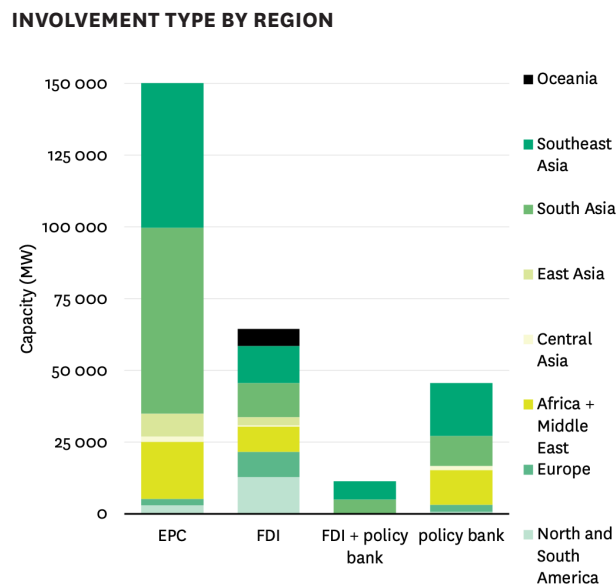
Many projects with Chinese involvement face significant, even permanent delays, especially coal plants in countries with looming overcapacity issues⁷. Although there is a significant amount of power generation capacity in Africa with Chinese involvement, looking at specific plants, we note that some of this capacity is represented by plants that are unlikely to ever enter operation, following years of pushback from civil society. Our dataset

6. Peng, "China's Involvement in Coal-Fired Power Projects Along the Belt and Road", Gei China, 2017.

7. S. Nicholas, "Shelving of huge BRI coal plant highlights overcapacity risk in Pakistan and Bangladesh", China Dialogue, 2020.

includes the Lamu plant in Kenya (3 coal-fired generating units of 350 MW each) and the Hamrawein plant in Egypt (6 coal-fired generating units of 660 MW each), both of which had planned to use Chinese contractors. The Lamu project faced significant legal challenges and opposition from local Kenyan activists⁸. The Hamrawein project was cancelled in 2020 as Egypt's electricity authority opted to focus on renewable energy⁹.

FIGURE 2 • CHINESE OVERSEAS POWER PLANT INVOLVEMENT TYPE BY REGION



Regional Disparities by Fuel Type

Looking at the regional variation in type of generation supported by different kinds of Chinese finance, we find that China's policy banks have almost entirely supported coal projects abroad, exclusively so in Central and South Asia (Figure 3) over the time period covered in our dataset, 2000-2033. Among a wider range of energy types not included in this analysis, it is known that hydropower follows coal as the second largest source of global capacity receiving Chinese policy bank finance and FDI. By looking only at coal, gas, wind, and solar, our analysis shows just how stark China's focus on coal has been, compared to wind and solar, for policy bank finance.

China's foreign direct investment has favored investments in gas, with a majority of capacity receiving Chinese FDI in Africa, East Asia, and Southeast Asia represented by significant capacities of gas plants (Figure 3).

Europe has received policy bank finance exclusively for coal and gas, while Chinese FDI going to Europe is split between natural gas plants and wind generation, with a small amount of solar. We find that the United Kingdom is the predominant destination for both Chinese FDI within

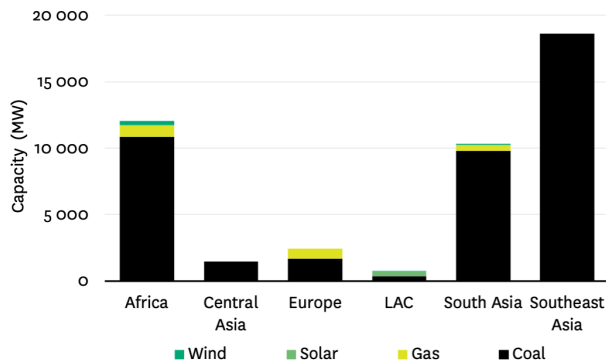
8. Shi, "Kenyan Coal Project shows why Chinese investors need to take environmental risks seriously", China Dialogue, 2021.

9. Farag, "Egypt postpones \$4.4 billion, 6GW coal plant, pushes renewables instead", Institute for Energy Economics and Financial Analysis, April 2020.

the European region, representing 48% of FDI capacity in Europe.

FIGURE 3 • REGIONAL FUEL BREAKDOWN FOR CHINESE

POLICY BANK FINANCE

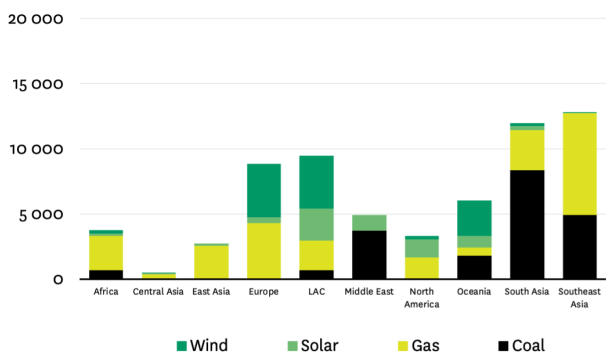


Our finding that a significant amount of Chinese FDI goes towards natural gas power represents a major step towards understanding the broader fossil fuel portfolio of China's overseas activity. Prior research and advocacy has heavily focused on Chinese involvement with global coal-fired power plants. This represents a future area for research, especially the emissions impacts of Chinese gas FDI.

Interestingly, the portfolio of Chinese overseas finance for power generation does not appear to have become cleaner over time. Following major commitments to low-carbon emissions trajectories such as the Paris Agreement in late 2015, the overall composition of global power plants receiving Chinese finance has not significantly changed. Although policy bank finance is generally on the decline, in recent years it continues to be essentially entirely for coal-fired power generation. Focusing on plants that came into operation between 2000 and 2021, we see that annual FDI has oscillated between renewable-heavy and fossil-heavy projects over the past few years (Figure 4).

FIGURE 4 • REGIONAL FUEL BREAKDOWN FOR CHINA'S

FOREIGN DIRECT INVESTMENT



Regional Policy Barriers to China's Overseas Renewable Energy Investment

Given the trends we have identified of significant Chinese FDI into overseas natural gas plants and no evidence of transition towards renewable energy in recent years, in this section, we explore policy barriers to promotion of renewable energy through Chinese overseas development finance, FDI, and construction arrangements. With China's recent announcement of a commitment to achieving carbon neutrality by 2060, there is an increasing discrepancy between the types of power generation China is promoting domestically compared to overseas. Will Chinese companies expand their dominant position in domestic solar and wind installations to more projects overseas?

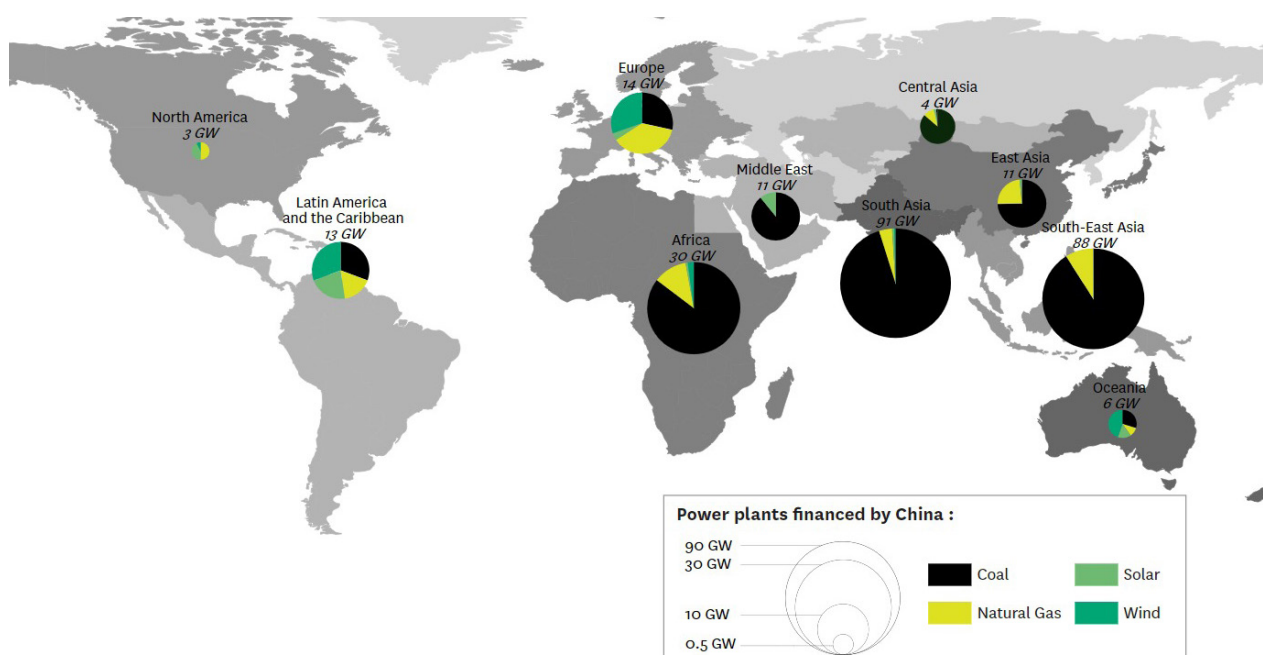
In terms of the other countries within the Belt and Road Initiative, research suggests that there have been strong preferences for lowest-cost electric power generation, which often translates into local policymakers' preferences for coal power plant construction¹⁰. However, as more nations announce decarbonization commitments as part of the Paris Agreement, it is likely that there will be greater interest in increasing renewable energy's role in more countries. However, many barriers still exist to increasing investment in global renewable energy. These barriers are both general to renewable energy investment, but must be specifically addressed with regards to the Chinese financing context.

Renewable energy is increasingly economically viable on a stand-alone basis. However, many developing countries face underdeveloped capital markets to finance renewable energy infrastructure. Thus, attracting and accessing more foreign capital is necessary to finance projects. This requires a comprehensive enabling environment on the part of the host country, including changes in policy, financing, and planning.

While there have been some recent advances in innovative partnerships between philanthropy, donor governments, local governments and businesses, such efforts have not been scaled up to the level needed to help countries meet their Paris Agreement targets. Countries can create a more attractive investment environment for renewables by re-directing fossil fuel subsidies towards renewables. The broader grid system must also be considered. In many countries, outdated or underdeveloped grid infrastructure is a limiting factor for renewables integration (IRENA 2018), leading to high risk aversion from grid companies and conventional lenders. For example, in rural areas with low electricity access, renewable energy buildout may need to be relatively distributed and small-scale, leading to comparatively higher transaction costs

10. E. Downs, "The China-Pakistan Economic Corridor Power Projects: Insights into Environmental and Debt Sustainability", Columbia University Center on Global Energy Policy, 2019.

FIGURE 5 • AUTHOR'S DATASET: POWER PLANTS FINANCED BY CHINA, UNDER CONSTRUCTION OR IN OPERATIONS (2000-2033)



and less commercial appeal¹¹.

Chinese financiers and construction companies can play a role in facilitating the pipeline for renewable energy overseas. As China increases its focus on a green Belt and Road Initiative, there may be more opportunities for host country stakeholders active in sustainability initiatives to connect with interested stakeholders or investors in China. China has a major comparative advantage not only in manufacturing wind and solar generating technology, but also related technology that can support the integration of renewables, like ultra-high-voltage transmission lines and energy storage. However, there has yet to be a systematic effort from within China to direct overseas energy investments towards renewables or to facilitate Chinese renewable energy companies in going overseas. A recent report sponsored by China's Ministry for Ecology and Environment introduced a "traffic light" system to grade investments on their sustainability (BRI IGDC 2020), but such a rating system has yet to be incorporated into decision-making. A major area of opportunity is facilitating the transfer of Chinese technical capacity through capacity building initiatives that can help host countries with energy planning, renewables integration, modern grid design and piloting. Chinese companies that are closely involved in the region, either as construction contractors or as shareholders in local grid companies and generation projects, have very valuable experience in clean energy and can be a key resource for renewable energy transition.

11. M. Muñoz Cabré et al., "Expanding Renewable Energy for Access and Development: the Role of Development Finance Institutions in Southern Africa", Boston University, Global Development Policy Center, 2020.

Given that our data has revealed a major concentration of fossil fuel power generation with Chinese finance and investment in Asia, we examine three subregions within Asia to assess the state of renewable energy and specific policy barriers.

Central Asia¹²

The region has rich renewable resource potential, including wind resources in Kazakhstan and solar in Uzbekistan. However, the aging power generation infrastructure in the region needs modernization¹³. Moreover, Central Asia is 42-73 percent rural and many areas have yet to be electrified¹⁴. Investment in renewables has been low, with most projects promoted by multilateral development banks such as the European Bank for Reconstruction and Development, the Asia Development Bank, and the World Bank, while private sector investors have only played a small role thus far.

Given Central Asia's prominence in the Belt and Road Initiative (the BRI was officially launched during Xi Jinping's visit to Kazakhstan in 2013), there is room for more Chinese engagement in renewable energy, especially through FDI. Central Asian governments need to articulate demand for overseas investment for renewables and provide quality information about the region to attract investors. Countries can educate the public on the importance of renewables through issue linkages, such as

12. Includes Mongolia, Kazakhstan, Tajikistan and Uzbekistan in the dataset.

13. Kim, "In Central Asia, a Soviet-era electricity network could power future energy sharing", 2020.

14. World Bank, "Rural population (% of total population) - Europe & Central Asia", 2021.

highlighting the impact that the smog generated by coal-fired power plants in Bishkek (Kyrgyzstan) has on public health and how renewables can mitigate that.

South Asia¹⁵

Many South Asian countries have untapped renewable energy resource potential, but a major investment gap. Countries in the region are currently facing large capacity payment issues for carbon-intensive power plants, meaning that system operators still need to pay power plants even when the plants are idle. This is a growing concern in Pakistan and Bangladesh, where power planning forecasts indicate there may be excess capacity in the years ahead if current planned investments, many of them with Chinese partners, are implemented. Pakistan has 10GW of coal-fired power generation capacity planned, but also has a 30 percent renewables target for 2030. Chinese investment in Pakistan has frequently clustered in special economic zones or industrial corridors, highlighting the need for more diverse energy investments both in terms of type of energy, location, and the necessary transmission and distribution infrastructure to facilitate energy access. The Bangladesh government received much criticism for a coal-heavy power development plan in 2020, and has since scaled back. In 2018, idle power plants in Bangladesh received over \$1 billion in capacity payments, a significant loss of government revenue¹⁶. Even given these losses, official future energy scenarios in Bangladesh still heavily feature coal, natural gas, and LNG imports¹⁷.

India remains a world leader in solar installation and bringing down the levelized cost of electricity for solar energy. India may propose a World Solar Bank to finance investments in solar energy, which will likely benefit neighboring countries seeking to scale up solar energy and move away from coal. However, there are competing influences from China and India within other South Asian countries, and geopolitical tensions may obstruct cooperation on renewable energy.

Southeast Asia¹⁸

The current status of renewables deployment is highly uneven between countries in Southeast Asia. Some countries are still facing electricity access issues, namely Myanmar and Cambodia. However, other countries have many “shovel ready” projects in renewable energy looking for financing. Given grid interconnections between some countries and China, careful planning of renewable en-

ergy expansion can help address issues with access and reliability in southern China, Laos, and Myanmar. Despite proximity to China, Chinese renewable energy developers have yet to make major headway into Southeast Asia.

Some Southeast Asian countries are emerging as regional energy developers, especially Vietnam and Thailand. Vietnam recently extended its feed-in-tariff by two years, and Malaysia announced plans for a large-scale solar program which will generate thousands of jobs. Vietnam’s impressive growth in renewables is a success story, including the move from feed-in-tariffs to auctions, but the risks of over-building gas infrastructure will need to be addressed as well. Given China’s involvement in the full range of countries in Southeast Asia, there are opportunities for regional collaboration on development of renewable energy projects that take advantage of positive experiences both from China and Vietnam, for example.

Discussion

Given rapid global expansion in renewable energy, it is evident that renewable energy investments are profitable, economically viable, and critical to achieving climate goals. China can facilitate this continued global expansion if it aligns its domestic focus on carbon neutrality and green development with its overseas activities in BRI countries. Many BRI countries are developing countries that can use Chinese assistance to develop modern, clean energy systems with less environmental impact. Our data has shown that despite a major focus on fossil fuels, especially in certain regions, China is to some extent already facilitating renewable energy overseas in the form of development finance and FDI. Although not included in our study, Chinese construction contractors and equipment exporters are also playing a role in overseas renewable energy development.

Positive Case Studies

Given the general and regional barriers discussed above, we sought to identify positive case studies of Chinese involvement in overseas renewable energy in order to glean policy lessons for implementation and scaling. Some notable examples of Chinese involvement in overseas renewables projects include:

- The Sweihan Photovoltaic Project, a 1.17 GW project jointly developed by China’s JinkoSolar and Japan’s Marubeni in Abu Dhabi, UAE, which includes a 25 year power purchase agreement (PPA) with the Abu Dhabi Water and Electricity Authority;
- Sinomach and General Electric’s cooperation on a 100 MW wind power demonstration project in Kipeto, Kenya;
- Chinese financing and construction of the 300 MW Cauchari Solar PV plant in Argentina, expanding

15. Includes India, Bangladesh, Sri Lanka, Nepal and Pakistan in the dataset.

16. S. Nicholas, “Shelving of huge BRI coal plant highlights overcapacity risk in Pakistan and Bangladesh”. China Dialogue, 2020.

17. A. Gulagi, et al., “Current energy policies and possible transition scenarios adopting renewable energy: A case study for Bangladesh”, Renewable Energy 155, 2020.

18. Includes Cambodia, Indonesia, Laos, Malaysia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand and Vietnam in the dataset.

to 500 MW over time. The \$390 million project is primarily being funded by the Export-Import Bank of China and Shanghai Power Construction is leading the construction using Chinese company Talesun's solar panels;

- The acquisition of an 80% stake in the German Meerwind offshore wind farm by the Three Gorges Group;
- The Silk Road Fund's purchase of shares in a Shanghai Electric and Saudi ACWA concentrated solar power project;
- PowerChina participated in the Dawood Wind Farm project in Pakistan as the developer and EPC.

China's renewable investments abroad are not limited to BRI countries. Chinese financing for specific renewable energy projects has occurred in Australia, the United States, and the United Kingdom, for example. Chinese financiers may be willing to work with partners in such countries on renewable energy due to relatively developed energy markets that provide greater policy certainty for solar and wind development, either through incentives such as renewable portfolio standards, tax cuts, or other policy measures. In contrast, investment in renewables has been lower in countries that do not offer a stable policy environment for renewables deployment. While the technical renewable energy potential in regions such as Southeast Asia is very high, policy incentives for Chinese engagement in the region are still lacking, as discussed above.

In terms of solar photovoltaics specifically, as the top manufacturer of solar PV products, China has exported these products to an increasingly diverse array of countries around the world in response to growing demand for low-cost, low-carbon energy¹⁹. Private Chinese companies like Jinko Solar, Canadian Solar, LONGi, Trina Solar, JA Solar and more have established solar cell and module production bases in countries like Vietnam, Malaysia, Thailand, Indonesia, and Germany, forming a supply chain and market network of high-end solar equipment connecting China with foreign countries. In going global, these companies have lowered global solar prices through their highly efficient vertical supply chains. Chinese solar companies provide FDI, construction arrangements, and equipment sales and services.

In terms of wind, Chinese power companies including the China Three Gorges Corporation, the China General Nuclear Power Group, the China Energy Investment Company, Goldwind, Envision Energy, Ming Yang Smart Energy, etc. have participated in the investment and construction of wind projects in the UK, Germany, Australia, and others.

19. M. M. Jackson, et al., "A green expansion: China's role in the global deployment and transfer of solar photovoltaic technology", *Energy for Sustainable Development* 60, 2021.

Policy Recommendations

We focus our policy recommendations on three key groups: Chinese institutions, host countries, and global partner institutions.

Chinese Institutions

At present, BRI deals between China and host governments are often led by Chinese State-Owned Enterprises (SOEs), with large projects requiring approval from China's National Development and Reform Commission and/or other government agencies. As such, project recommendations may sometimes be driven more by China's domestic supply side considerations for SOEs (who are more experienced in fossil-fuel related infrastructure), and less motivated by what would be most sustainable for the host country. China has already signalled high-level political commitment to green the BRI in principle, though implementation remains a challenge. There are already initiatives such as BRI Low Carbon Cities, tools like the China Green Finance Committee's calculator for environmental impacts, the Committee's innovative green finance products to lower the cost of renewables, and the green project investment database under the Green Investment Principles for the Belt and Road, which can help potential green BRI projects access global public sector and private sector capital.

Further measures that could have significant impact include the following:

- China can share its expertise in innovative financial products: sustainable bonds, green/ESG bonds, crisis recovery facilities.
- As government funds are limited, including for China, Chinese companies can increase their engagement with multilateral development banks and financial institutions such as EBRD, African development bank (ADB) and Asiatic infrastructure investment bank (AIIB) to pool more capital for renewable energy projects.
- China could promote and contribute to more integrated solutions for energy infrastructure in host countries, including grid infrastructure and capacity building that are choke points for the broader deployment of renewable energy.
- Chinese civil society organizations can connect with those in developing countries for greater South-South cooperation and exchange on promoting renewable energy.
- China can consider encouraging its companies to enhance environmental and climate considerations for project investments overseas, e.g. through the "traffic light system" discussed earlier.

Host Countries

To green the BRI, host countries must articulate demand for more renewable energy investments, and less fossil energy investments. Countries should increase collaboration on renewable energy investment with Chinese SOEs and private companies that are contractors, project developers, and financiers.

Many challenges are still ongoing in host countries, including political challenges of reforming fossil fuel subsidies and introducing carbon pricing, finding transition solutions for countries dependent on exporting fossil fuels, the need to take into account worker transition, and the need to diversify local economic models.

Further measures that could have significant impact include the following:

- Countries must address the conservatism in behavior of relevant ministries and procurement officers. These stakeholders can benefit from learning about the rapidly changing energy landscape so they are less likely to prefer fossil fuel infrastructure technologies that could pose long-term stranded asset risks or burdens for government budgets.
- More government guarantees for renewable energy projects can put them on a more level playing field.
- A growing market for green investments and bonds can attract more private sector capital.
- One potential idea is to develop a green coalition of BRI nations, with a shared investment framework and higher environmental, climate and health standards. A green coalition could link regulators, utilities, financiers, project developers and others, standardizing procurement policies. Many resources exist, but countries should improve information sharing via existing channels (e.g. ASEAN, Southeast Asia Energy Transition Partnership). Having Green BRI “pilot countries” will allow learning on scaling green investment.
- Countries can develop enabling conditions for sustainable energy, such as stable regulatory environments for renewables with clear operational guidance, mechanisms like PPAs, and improve the conversation between regulators, investors and utilities.
- Adopt a long term carbon neutrality goal, as China and several other countries have done, to drive policy and finance across all parts of the economy.
- Conducting more public awareness programs on the benefits of renewables and of reducing pollution or smog.

Global Partner Institutions

Global institutions and partners can help enable Chinese institutions and host countries to develop renewable energy through these measures:

- Global institutions such as development banks, intergovernmental institutions and coalitions can encourage the formulation of stronger environmental and social governance standards around BRI projects – articulating the need for these policies with key Chinese institutions such as the National Development and Reform Commission, Ministry of Commerce, and the State-owned Assets Supervision and Administration Commission, and with ministries in each BRI country.
- Global institutions should encourage China to implement green investments with clear targets and timelines.
- Countries and partner institutions can support more rapid deployment of green projects by establishing a Green Guarantee Fund to reduce project risk costs, such as through participation in the Green Investment Principles for the Belt and Road, which has already brought together 37 global institutions with total assets of over 41 trillion USD.
- Institutions can support the development of green BRI pilot countries, facilitate dialogues and exchanges on standardization of project development and procurement, help crowd in private finance, provide blended financing and other options.
- Institutions can accelerate South-South peer-to-peer awareness raising and learning, investment, and development by promoting regional hubs of excellence.
- The private sector and multilateral financial institutions can engage more with Chinese companies that are leaders in renewable energy.
- Multilateral Development Banks could help bring initial capital support to finance higher risk clean project pilots, as well as financing development missions such as education and awareness enhancement.

Conclusion

Renewables are already competitive with coal plants in many countries in Asia such as China, South Korea, Thailand, Vietnam²⁰, and more and more fossil fuel investments may become “stranded assets,” which are as disastrous financially for investors as they are environmentally for local communities. Our data shows that, from 2000, China has provided development finance weighted towards coal, and FDI weighted towards natural gas, as well as

20. Wood Mackenzie, “Renewables in most of Asia Pacific to be cheaper than coal power by 2030”, 2020.

significant construction arrangements for global coal-fired power plants, and that renewable energy has not superseded fossil investments in recent years.

Fortunately, the efforts to green the Belt and Road can help to drive financial flows towards more sustainable renewable energy resources. This paper has highlighted the current policy barriers to Chinese finance for renewable energy around the world, and identified policy recommendations to overcome these barriers.

In early 2021, the Chinese embassy in Bangladesh indicated via a letter that the Chinese government would not finance a coal plant in Bangladesh as “the Chinese side shall no longer consider projects with high pollution and high energy consumption, such as coal mining, coal-fired power stations, etc.”²¹. During the annual meeting of China’s National People’s Congress in 2021, a researcher from the State Council indicated that China is no longer financing coal power projects and focusing on solar, wind and nuclear projects to promote a green Belt and Road Initiative²². A shift away from coal is a positive development in terms of global emissions. Further research will be required to verify if the end of coal support from China will cover only policy bank financing, or whether this restriction will also extend to other areas such as construction arrangements and FDI.

Method: Data Collection

We assembled a novel dataset on global power generation projects spanning Chinese involvement via development finance, foreign direct investment, and construction arrangements. We selected only power plants with coal, gas, wind, and solar as their primary fuel, and excluded canceled and retired plants from 2000 to 2033. We also only examine plants outside of China.

For power plants with Chinese development finance from policy banks and foreign direct investment, we used the Boston University China’s Global Power (CGP) database²³, which spans power plants commissioned and planned between the years 2000 and 2033. Plants with years of commission from 2021 and beyond are under planning or construction, while plants from 2020 and prior have been verified to be in operation.

To identify construction arrangements, we used the Platts World Electric Power Plants (WEPP) database to identify the country of origin for the architecture and engineering or construction company involved with each individual plant. For EPC arrangements, we only investigated coal plants due to the relative completeness of data on this type of power plant. We began with a list of known Chinese construction companies, and matched this list to the companies noted in the WEPP data. It should be noted that these plants with Chinese construction contractors are mutually exclusive from the CGP dataset; that is, these represent power plants without identifiable Chinese finance or investment, yet that still have Chinese construction contractors. There are likely a significant number of global power plants that have both Chinese finance or investment and a Chinese construction contractor. Given significant missing data on engineering and construction companies at the plant level, our estimates should be seen as a bare minimum for Chinese construction arrangements for global coal plants.

The final dataset includes 1,027 coal, gas, wind, and solar plants representing 272 GW of capacity, including operational and planned plants between 2000 and 2033 (Figure 5).

21. China Economic Review, “China turns its back on Bangladesh BRI coal projects”, 2021.

22. Xinhua News Agency, “Interpretation of the Two Sessions: The “Belt and Road” construction will maintain its upward momentum in 2021”, 2021.

23. K. Gallagher et al., “China’s Global Power Database”, Global Development Policy Center, Boston University, 2019 ; K. Gallagher et al., “China’s Global Energy Finance”, Global Development Policy Center, Boston University, 2019.



Clémence Pèlerin • GREEN co-editor-in-chief

Hugo Marciot • Holds degrees in Law and in Energy Economics. He currently works on public policy and electricity markets

China at the Gates of the European Power Grid

China's conquest of the European power sector

Energy has a very high capital intensity at all stages of its value chain. But most of all it contributes to socio-economic development and has numerous geopolitical and environmental impacts. Today, although energy consumption in Europe is stable or even declining, electricity is a major and growing part of this market. On the one hand, new uses, mainly arising from digitalization, are increasing the demand for electricity; on the other hand, energy transition policies aim to electrify overall energy consumption so as to reduce greenhouse gas emissions downstream while decarbonizing production upstream, particularly through renewable energies. For these reasons, investments in the power sector and its infrastructure are growing significantly, mainly in Europe but also in other economically powerful countries.

The energy sector is indeed an integrated part of the new Chinese Belt and Road Initiative (BRI). Moreover, according to recent research, energy represents two-thirds of China's spending on the BRI, the remainder going to the transportation and telecommunications sectors¹. In Europe, the surge in Chinese investments across all sectors is due to a combination of the debt crisis, beginning in 2008, and the perceived mutual economic opportunity for European and Chinese institutions to deepen their relationship, notably through the purchase of euro bonds (a common debt instrument for eurozone countries) and investments in strategic infrastructure. For example, between 2010 and the end of 2012, the volume of Chinese investments in the European Union quadrupled, from 6 to 27 billion euros². This was due to the decrease in asset values and to a revised Chinese policy for overseas mergers and acquisitions. Underlying this, the long-standing trend of deindustrialization in the West, as well as China's ambition to pursue an active investment policy in Europe, further contributed to the equation. Between 2015 and

2016 alone, Chinese investment in the EU grew by 77%; among the most concerned sectors were telecommunications, real estate and automotive. In 2019, the transport, energy, utilities and infrastructure sector was the fourth largest sector of Chinese foreign direct investment (FDI) in the EU, with 800 million euros³.

The Global Interconnection Initiative: The view of Climate Leadership through Electricity Infrastructure

Within the energy sector, electricity is an interesting component of the BRI in Europe for China, as it is a strategic sector for the Union. More specifically, as it is part of a complex value chain where competition, security and innovation issues intersect, electricity transmission is one of the pillars of China's New Silk Roads. This is evidenced by the mega-project to intercontinentally link the Chinese and European power grids and, in the longer term, the global linking of electricity networks on all continents. Presented in 2015 by President Xi Jinping at the United Nations Sustainable Development Summit, this project, known as the Global Interconnection Initiative, is led by the Global Energy Interconnection Development and Cooperation Organization (GEIDCO), an international nongovernmental organization. The project aims primarily at developing electricity infrastructure on both sides of the Eurasian continent. According to GEIDCO, the Global Energy Interconnection project intends to establish "a modern, clean and electricity-centric energy system that is globally interconnected, jointly built, and mutually beneficial to all"⁴. This international infrastructure responds to three well-identified challenges in the energy transition. It will interconnect national and regional energy systems in order to (1) facilitate and improve the integration of renewable energies, (2) increase the flexibility of networks in the face of rising alternatives and intermittent energies, and (3) ensure greater security of electricity supply, in a context of strong electrification of the energy mix. The organization's ultimate objective is to achieve low-carbon and sustainable development⁵.

This project is of unprecedented scope and will be deployed in successive stages through 2070. The first stage, estimated to start in 2035, plans to connect the Chinese to European domestic networks; the second stage, in 2050, aims at developing the African and American networks; finally, the third stage will focus on connecting the Arctic, linking the five continents through these energy arteries⁶. In addition to its futuristic dimensions, this project is built on Ultra High Voltage ('UHV') network technology for the transmission of very high-speed, alternating or

1. T. S. Eder, J. Mardell, "Powering the Belt and Road", Mercator Institute for China Studies, June 2019.

2. J. Anderlini, "Chinese investors surged into EU at height of debt crisis", Financial Times, October 2014.

3. A. Kratz, M. Huotari, T. Hanemann, R. Arcesati, "Chinese FDI in Europe: 2019 update", Mercator Institute for China Studies et Rhodium Group, April 2020.

4. Global Energy Interconnection, Development concept, see: en.geidco.org.cn/aboutgei/.

5. Global Energy Interconnection, Global consensus.

6. Global Energy Interconnection, Development strategy.

direct electrical current. China has been developing this technology since the end of the 2000s as a necessary supplement to the deployment of telecommunications technologies such as 5G. Thanks to substantial government and local funding and the large-scale installation of these networks (in 2020, China is expected to spend more than \$20 billion on the deployment of UHV projects)⁷, China has already managed to significantly reduce the costs, although several difficulties remain. One is technical and lies in the fact that, despite fewer electricity losses by the Joule effect, the transmission distances of the GEI project will necessarily imply significant losses in the transmission of electricity, which will further reduce profitability. The other difficulty is economic: UHV cabling is very expensive, especially on a continental and global scale, even though economies of scale theoretically seem considerable. While the post-coronavirus context could slow down the deployment of this project abroad, it could be an opportunity for China to activate economic stimulus plans through public investment and major industrial programs⁸. The Chinese Communist Party has already taken that step with the announcement of new infrastructure projects in March 2020⁹.

Since its creation, GEIDCO has engaged in international partnerships and the fight against climate change within climate negotiations and initiatives. The organization has published multiple Action Plans, including the 2017 Action Plan to promote the United Nations 2030 Agenda for Sustainable development, the Action Plan to promote the Paris Agreement during the COP 24, and the Action Plan for the Promotion of Global Environmental Protection¹⁰. In an effort to enhance the legitimacy of the project, partnerships with more than 70 countries and organizations such as UNFCCC or the G20 Global Infrastructure Connectivity Alliance have been concluded. In this regard, it is particularly interesting to observe how the rhetoric promoting this project, which is also an integral part of the Belt and Road Initiative, is meant to coincide with global policies to fight climate change. China has indeed installed more renewable energy facilities than any other country in the world and has increased both political and industrial initiatives to assert its leadership in this area. China's foreign investments in fossil fuels contradict this image of an ambitious environmental player both at home and in international negotiations¹¹.

The debt crisis in Europe and the Trojan horse of Chinese strategic investments in electricity transmission

The history of Chinese investments in strategic infrastructure stem from the economic and financial crisis of 2008-2012. In the years immediately following the financial crisis, Southern Europe was the main recipient of these transactions. Italy accounted for nearly the annual total in 2014 and in 2019 became the first European country to officially join the BRI by signing a memorandum of intent and more than 2.5 billion euros in contracts. A number of symbolic announcements marked the 2010s, such as the acquisition of a 51% stake in the Greek port of Piraeus in 2016, the launch of the 16+1 Format in 2012¹², and the increased cooperation between the Italian shipbuilder Fincantieri and the Chinese State Shipbuilding Company.

An analysis of Chinese investments in European energy infrastructure reveals recurring methods and objectives. First, Chinese companies usually acquire majority stakes through initial minority investment. In addition, these heavy investments focus on specific segments of the energy value chain, aiming for both influence and, most of all, profitability. In this regard, power networks are ideal investments as they are regulated, natural monopoly assets in national territories¹³. Whether in electricity transmission or distribution networks, the 2010s recorded substantial investments, first in Southern European countries, which were undergoing massive privatizations, and later in Northern Europe.

In 2011, the Portuguese government sold its shares in the national transmission system operator (TSO), Energias de Portugal (EDP), as part of the rescue and privatization program set up by the European Commission and the IMF. The state-owned company China Three Gorges (CTG) then bought them for 2.7 billion euros. Six years later, as the main shareholder with 23.27% of capital, CTG filed a takeover bid to buy out all EDP's remaining capital for 9 billion euros. The initiative was prevented by EDP's statutes, which prohibit any shareholder from holding more than 25% of capital. The takeover bid, launched in May 2018, was dropped almost a year later as shareholders refused to change said statutes. However, this is not the only remarkable investment in the Portuguese power system: in 2012, CTG also acquired 49% of EDP Renewables – EDP's renewable energy subsidiary – and the state-owned investment company CNIC Corporation Limited in turn acquired 5% of EDP's capital in 2015. State Grid Corporation of China (SGCC) also purchased 25% of the grid op-

7. Bloomberg News, "A 1,000-Mile Long Clean Energy Artery Is Completed in China", June 2020.

8. 8.7 priority areas in the field of infrastructure have been identified by the PCC for post-Covid economic recovery: the 5G network, industrial IoT, data centers, UHV transport networks, IRVE and high-speed lines between the country's major cities.

9. "China Develops \$26bn Ultra High Voltage Electrical Grids to Stimulate Economic Recovery", Power-Technology.com, May 2020.

10. Global Energy Interconnection, *Global consensus*.

11. C. Lizé and C. Pèlerin, "Climat : où va la Chine ?", Le Grand Continent, April 2020.

12. The 16+1 format is a multilateral economic partnership signed by China and 16 central and eastern European countries (Albania, Bulgaria, Bosnia and Herzegovina, Croatia, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, the Czech Republic, Romania, Serbia, Slovakia, Slovenia).

13. N. Wakim, "Comment la Chine achète l'Europe de l'énergie", Le Monde, August 2018.

rator Redes Energéticas Nacionais (REN) for €387 million in early 2012, becoming the largest shareholder. It was then in a position to appoint the chairman and three members of the board of directors¹⁴.

Portugal is the best illustration of this Chinese strategy of investing in several links of a strategic and traditionally monopolistic value chain which has been favoured by European austerity¹⁵. Other Southern European countries such as Italy or Greece have experienced the same investment moves. In 2014, SGCC bought 35% of the Italian public holding CDP Reti for 2.4 billion euros, the largest investment SGCC has ever made abroad, but also the largest contract ever signed by China in Italy¹⁶. CDP Reti is also a 30% shareholder in the TSO Terna and the gas operator Snam. Through this acquisition, SGCC therefore took a blocking minority and a voting right in the board of directors of these two companies. Although it is not a TSO, the equipment manufacturer Shanghai Electric Power entered into a strategic partnership with the Maltese TSO Enemalta in December 2014 by acquiring a 33% stake. In Greece, SGCC had already acquired a minority stake (24%) in the Independent power transmission operator (ADMIE) for 320 million euros in 2014, the Italian TSO Terna entering ADMIE's capital at the same time. Once again, the Greek government sold its shares as part of the Greek rescue plan and to comply with requirements imposed by the IMF in exchange for funding.

Northern Europe has not been spared from this trend, although it is significantly different. In the United Kingdom, the economic context surrounding these decisions is dominated by Brexit and has more to do with reorienting investment in the British economy outside the Union. In 2017, Theresa May's government nevertheless approved the sale of 61% of the TSO National Grid gas division to an international consortium including the China Investment Corporation (10.5%) and investors such as Macquarie (14.5%)¹⁷. Moreover, SGCC acquired 24.92% of the holding company Encevo, which in turn owns the Luxembourg TSO Creos. Yet, in other instances, government interventions effectively blocked some takeover attempts, thereby preserving European shares in some TSOs. For example, the Spanish government did not respond to SGCC's interest in purchasing its share of the TSO Red Eelctrica de Espana (REE). In Germany, where power transmission relies on four different TSOs, the 50Hertz TSO has on two occasions seen 20% of its capital put up for sale by their respective shareholders. SGCC twice attempted to acquire them in order to give its equipment subsidiary a significant advantage in future calls for bids related to the

extension of the German network¹⁸. And German institutions twice opposed these acquisitions by involving the public bank Kreditanstalt für Wiederaufbau (KfW). In Belgium, the electricity distributor Eandis was also targeted by Chinese investors, but the city of Antwerp barred an attempt to buy 14% of the shares¹⁹. To date, there have been successful acquisitions in European TSOs by Chinese investors in seven European Union member states.

A recent and heterogeneous awareness in Europe

In specific terms, these acquisitions have two direct implications for the European electricity sector. On one hand, they often grant voting rights to Chinese state-owned or parapublic companies on boards of directors of grid operators, which are directly involved in the energy security of member states. On the other hand, they reinforce a deeper financial dynamic which has already affected other components of the electricity value chain, such as power generation. But these acquisitions make perfect sense in light of the aforementioned GEI project: Italy and Greece, both in terms of ports and energy, are ideal entry points for the transcontinental grid. Some analysts even fear that a sufficiently important Chinese influence on the European electricity infrastructure will eventually allow China to sell electricity produced within its territory to EU member states at a cheaper price than the domestic market as a result of the abundant, and even surplus, electricity production from the world's first renewable power plants. At first glance, such a transcontinental network may seem advantageous in every way. It would grant access to cheap renewable electricity, making it beneficial for both the environment and the European consumer. But these advantages hide less explicit economic and geopolitical effects. The effect of economic dumping and technological vulnerability, as already observed in other sectors, would be particularly strong in the case of a transcontinental network. China would indeed continue to supply European countries with renewable means of production (solar panels, wind turbines, power electronics, etc.), while providing them with renewable electricity at a lower price than Member States could sell theirs; a phenomenon which would arise from the combination of the scale effect of its plants and the internalization of production costs. Furthermore, an abundance of Chinese renewable power and its low price could make European countries highly energy-reliant on a foreign power, thereby replicating the dependence on Russian gas. Finally, the potential complementarity of production patterns (Chinese renewable production reaching high levels when European renewable production is low, for example at night, due to time differences) could, in the most extreme scenarios, lead to significant marginalization of conventional European (i.e. thermal) production, which will likely

14. A. Khalip, "Factbox: Chinese investments in Portugal", Reuters, May 2018.

15. X. Yi-chong, *Sinews of Power. Politics of the State Grid Corporation of China*, Oxford University Press, 2019.

16. "Le chinois SGCC finalise l'acquisition de 35 % des actions de l'italien CDP Reti", French.china.org.cn, December 2014.

17. C. Peterson, "CIC buys 10.5% of National Grid's gas division", China Daily, December 2016.

18. DW, "China's SGCC to buy stake in German grid operator 50Hertz", February 2018.

19. A. Hope, "Antwerp puts end to potential Chinese energy deal", Flanders Today, October 2016.

be less needed.

Chinese investments in European electricity infrastructure peaked between 2012 and 2016, at the height of Member States' economic vulnerability, primarily in Southern Europe. It is interesting to note that this trend was nevertheless preceded by a decade of close cooperation between the EU and China on energy and economic matters. This is evidenced in particular by the launch of the EU-China Comprehensive Strategic Partnership in 2003 and the EU-China 2020 Strategic Agenda for Cooperation.

The tone of strategic cooperation between China and the EU has substantially changed compared to the early 2000s, resulting in member states positioning themselves around two political stances with increasing assertiveness. On the one hand, public opinion and politicians viewing these investments as an economic and industrial opportunity; Italy's official membership in the BRI and the conclusion of a Memorandum of Understanding in March 2019 (two years after the signing of a first Action Plan for the Strengthening of Economic, Commercial and Cultural-scientific Cooperation between Italy and China 2017-2020) is a good example. By formalizing a privileged relationship that satisfies both Italian export opportunities to China and the Chinese investment strategy in Europe, both parties seek to link Europe and China through Italy's "traditional role as terminal of the maritime silk routes"²⁰. The Under Secretary of State at the Ministry of Economic Development, Michele Geraci, even called on the European Commission to take greater account of Member States commercial interests in the construction of its trade policy with China²¹. This intervention is a sign of the political and commercial freedom that is being demanded at a time of disagreement between Member States on this issue. Portugal also concluded a memorandum of understanding with Beijing in December 2018 deepening economic cooperation within the BRI, mainly regarding infrastructure. Portuguese officials have nevertheless denied claims of a privileged relationship – or even dependence – with China²². But the Minister of Foreign Relations Augusto Santos Silva. But the Minister of Foreign Relations, Augusto Santos Silva, told the Financial Times that he hoped for "credible" offers from European and American investors in future calls for bids, lamenting that in the case of energy companies that were deregulated beginning in 2011, only Chinese investors were convincing²³.

On the other hand, other countries have recently toughened their approach to Beijing, among them Ger-

many, as previously mentioned, and France. Since 2017, the two countries have jointly called for new regulations regarding foreign investment (see below). Following the cooperation and the development of mutual economic opportunities that prevailed from the early 2000s to the mid-2010s, more and more voices in Europe are speaking out against a purely "competitive" approach to network infrastructures that pays little heed to their geostrategic importance. This view occupied a central place in the 2017 European debate around the questions of China's market economy status and the European institutions' response to the risks of dumping, a debate in which the European Parliament was given a central role²⁴. However, the increased visibility of the Global Energy Interconnection in international organizations, and its promotion by China, both in terms of development and energy transition, points to a discrepancy in European vigilance.

Still, electricity transmission infrastructure – owned by either their operators or by their government – are by their very nature essential to a country's economic and social activities. They are also hubs of technological innovation, and the interconnection of European networks makes the operation of each national grid particularly crucial for the supply of neighboring States. The continuous cross-border flow of electricity creates an energy solidarity that strengthens European cooperation and integration. These networks are a major strategic infrastructure for the European Union, as they facilitate the internal electricity market.

The crucial importance of these networks for the European power system – and, by extension, for the European economy as a whole – calls for special protection against foreign takeovers. Given that foreign interests do not necessarily align with the interests of EU Member States, any foreign acquisition would likely pose risks for the European electricity supply and its economies. Because these buyouts are massive and originate only from China, they are a major continental issue, especially as European electricity markets and systems are increasingly interconnected and weakened as a result. The presence of a third country in the capital of several major TSOs reveals the economic fragility of the EU electricity sector, which allows a third country to influence European energy security²⁵.

20. Memorandum of understanding between the government of the Italian Republic and the government of the People's Republic of China on cooperation within the framework of the Silk road economic belt and the 21st century maritime silk road initiative, March 2019.

21. S. Zheng, "Italian government's China expert urges EU to make it easier for member states to deal with China", South China Morning Post, May 2019.

22. "Lisbon rebuffs claims Portugal is China's 'special friend' in EU", Financial Times, January 2020.

23. Ibid.

24. G. Grésillon, "L'Europe trouve enfin la parade face au 'Made in China'", Les Échos, October 2017.

25. CREDITS: GREEN is publishing C. Pèlerin, H. Marcot, "La Chine aux portes du réseau électrique européen", Groupe d'études géopolitiques, Note pour l'action, January 2021.



An “Ecological Civilization”?

What is the Current Reality
for a Key Concept of China’s
Political Rhetoric on Ecology?

◀ **Boris Svartzman** • Franco-Argentinian filmmaker, photographer, and sociologist. Doctoral candidate at the Research Center on Modern and Contemporary China at EHESS (l’École des Hautes Études en Sciences Sociales) in Paris.
www.svartzman.com

Photo from the series “China in Change” / “Chine chamboulée” (2008).



Yifei Li • Assistant Professor of Environmental Studies at NYU Shanghai and Global Network Assistant Professor at NYU

Judith Shapiro • Director - Dual Degree in Natural Resources and Sustainable Development, School of International Service, American University, Washington

Clémence Pèlerin • GREEN co-editor-in-chief

Green Transition in China: At What Cost?

106

Green economics have become increasingly central to China's domestic and international politics since it announced its national strategy to build an "ecological civilization" in 2007. In this interview, the authors of China Goes Green (Polity, 2020) interpret the Chinese state's approach to environmentalism, how it is being used to reinforce authoritarian control, and the danger of climate overshadowing other critical social and environmental issues. With international cooperation on climate desperately wanting, they discuss how EU, US and Chinese climate policies can and should fit together ahead of the 26th UN Climate Change Conference planned for late 2021¹.

Clémence Pèlerin — In China Goes Green, you distinguish between environmental authoritarianism and authoritarian environmentalism. Can you explain this difference and how China's climate politics and policies have evolved?

Yifei Li — We set out to research authoritarian environmentalism, but our investigation took us somewhere that we didn't expect. People are frustrated by how democracies seem incapable of producing robust and effective responses to environmental challenges. You could even say that there is Western admiration for China's authoritarian, decisive approaches to environmentalism. In other words, if the end of environmental sustainability is noble enough, it could be used to justify the means of authoritarian governmental approaches. However, after a systematic review of Chinese environmental power on the ground, we found that environmental protection, instead of being the end, is becoming the pretext for the inten-

sification of authoritarian control at home, geopolitical leverage, and all sorts of international influences.

Judith Shapiro — I think some of the Western admiration for China's environmental decisiveness comes out of wishful thinking and a sense that the planet has run out of time. We get infatuated with the notion of "ecological civilization" because it sounds very forward-thinking.

You have described China's highly centralised approach to environmental policy. To what extent could this pose a problem to efficient policymaking?

Judith Shapiro — On the one hand, we must admire that the Chinese state is investing tremendous funds and institutional support into technological innovation for climate and other environmental concerns, whether in the form of think-tanks or places like Tsinghua University. Certainly, the US should admire it: there's no funding from the US National Science Foundation to this degree. On the other hand, while it is very exciting, it reflects a kind of technocratic approach to environmental policymaking in which engineers lead the process while citizens have no say. Occasionally, these engineers invent something, such as fuel-burning chambers which can shoot silver iodide into the monsoons coming up from India to create a "sky river" on the Tibetan plateau. Then, suddenly, they plan to install some 10,000 of these machines. What about the Indians who also need this water, or the Tibetans whose beliefs do not allow this sort of intervention? There is a notion here that people can conquer nature. Years ago, I worked on Mao's war against nature, and this really harks back to that - it shows the same kind of infatuation with high modernism that the American political scientist James Scott described back in 1999 in *Seeing Like a State*.

Yifei Li — When innovative capacity, epistemic power or knowledge is so centralised, it often means that Chinese state officials, well intentioned though they may be, just don't know what is happening on the ground to the point where they ignore inputs from ethnic minority groups and independent scientists. In this case, centralisation becomes a disservice to the Chinese state. They are pursuing a one-dimensional approach of what China is currently and what China could become moving forward. By being completely desensitised to the complexity of the nation and the diversity of society, Chinese state actors undermine the state's ability to govern well.

Judith Shapiro — In some ways, that's been part of the governance system of the Chinese Communist Party (CCP) from the beginning: the idea that the CCP represents the people and knows better than the people at the same time.

1. CREDITS: GREEN is publishing the interview with Yifei Li and Judith Shapiro, conducted by Clémence Pèlerin, "Green Transition in China: At What Cost?", published by Le Grand Continent, 11 March 2021.

How does this eco-modernism interact with the notion of ecological civilization?

Yifei Li — Ecological civilization is an overarching governmental strategy. There is a premature tendency on the part of many observers – both inside and outside China – to dismiss it as propaganda. Ecological civilization represents Chinese Marxism’s unique “innovation” to the classic Marxist formulation of the stages of development, from agricultural society to imperialism, to capitalism, to socialism and then, ultimately, to communism. Chinese state-sponsored Marxists are essentially suggesting that ecological civilization is the transitional stage from socialism to communism. So, they are suggesting that China is experiencing something that is Marxist but that Karl Marx himself didn’t even see. In that sense, it becomes a unique intellectual contribution.

China is also saying that before the Opium Wars in the mid-19th century it was at top of the world’s civilizations, but that since then, there has been a century of humiliation for China. The CCP sees itself as rejuvenating “the Chinese nation” and restoring China’s former glory: it is not just building any kind of civilization – it is building a unique, ecological kind of civilization. That, in a way, becomes the CCP’s branding of what it is doing in China. It’s important to recognise the centrality of ecological civilization to how the Chinese state is thinking about itself. Moving forward, environmental protection will continue to feature very prominently in Chinese state policies.

Judith Shapiro — It’s worth remembering that this notion has been included in the Chinese state constitution and the five-year plans: they could just as easily have used the phrase “sustainable development”, but they chose not to because that would have been a Western import.

Can you explain the phenomenon of “green grabbing” and what this tells us about the Chinese government’s approach to energy transition on the ground?

Judith Shapiro — In its various environmental programmes, the Chinese state furthers its goals vis-à-vis institutions and ordinary people. For instance, China has been building dams for a long time, and they often serve the interests of local officials who benefit by selling electricity. But now, with the commitment to carbon neutrality by 2060, it has become much easier for the state to justify the need to build these dams as part of a renewable energy portfolio. Hydroelectric dams are already incredibly contentious, both in China and abroad, and are resisted by the communities they displace. Countries downstream the Mekong river, such as Vietnam, have been enormously impacted by China’s dam-building. India is also very worried about China’s dam projects on the Brahmaputra river.

By listening to voices that resist the dams, the state can avoid making serious mistakes. For instance, the dam that was planned for the Tiger Leaping Gorge in Yunnan Province would have been catastrophically damaging to China’s intangible heritage, but it was abandoned in 2007 following a huge campaign. Unfortunately, some of those projects are back on the table and we must keep an eye on this new set of excuses for building hydropower, which is very bad for diversity, landscape laws and human rights.

Yifei Li — A lot of international admiration for Chinese environmentalism has been premised on China’s promotion of renewable energy. We need to be more careful here. Hydropower may be renewable from an energy perspective, but dams are essentially breaking off riverine ecosystems and have long-lasting social and economic impacts on local communities. We must ask ourselves, at what cost is China achieving its renewable energy policies?

To what extent can China’s transition accentuate social inequalities, both domestically and abroad?

Judith Shapiro — Environmental displacement is a core insight when considering climate justice. Across borders, dams are being built on the Mekong river to serve Chinese energy needs. Even along the Belt and Road, its infrastructure programme to connect Asia with Africa and Europe via land and maritime networks, China exports coal-fired power plants and searches for and extracts raw materials with severe environmental impacts. Environmental displacement is increasingly being shifted overseas to poorer communities who are in a weaker position to resist, whether in Africa, Latin America or even along the Belt and Road. Today, the Belt and Road is being framed as a win-win for China and its partners. It echoes the theory that late-stage capitalism needs to constantly look for new markets and raw materials.

Yifei Li — One example of urban-rural inequality is the recycling mandate in the city of Shanghai. Recycling has been carried out in this city for decades, and many migrant workers depend on it as their primary source of income. The government is now trying to build a formalised recycling system in the city, pushing out migrant workers and hiring locals instead. At the same time, they are gentrifying the city and limiting the economic space for migrant workers to continue to thrive in major metropolitan centers in Shanghai and in Beijing. That’s a common trend we’re seeing in other places too.

How do you reflect on the economic rationale of cost- benefit balance underlying the Chinese government’s ecological ambitions?

Yifei Li — China is using the Belt and Road initiative

as a mechanism to absorb its economic surplus. It is exporting high-speed rail technologies to its partners on the Belt and Road when China's domestic market has been saturated. The Belt and Road is becoming a Chinese economic growth strategy. What is mind-boggling is how, despite the environmental destruction caused by the Belt and Road initiative, Chinese state actors continue to call it "green, smart, win-win". There is abundant evidence of ecological habitats being destroyed, deep-water seaports damaging entire marine systems, and coal-fired power plants releasing more carbon into the atmosphere.

China announced a plan to reach peak carbon emissions no later than 2030, and then carbon neutrality by 2060. The real question is: how are they going to achieve it? Various local experiments seek to account for carbon neutrality. In Beijing, for example, anyone wanting to host a sporting event must do what they call a "full-scale carbon inventory" by calculating how much energy, fuel, water and so on it will require. The total will then be compared to the carbon quota assigned by the government. Anyone exceeding their quota must go to the carbon cap and trade mechanism in Beijing to buy more carbon credits. It strikes me as a very risky experiment. It gives Chinese government actors sweeping authority in determining how much carbon any event is entitled to release. It is not far-fetched to imagine a scenario in which events better aligned with the state's ambitions get more credits. If or when the 2060 carbon neutrality pledge is achieved in this fashion at a national scale, it will be very worrying.

Is China aiming to gain worldwide intellectual leadership on how states can reconcile economic development and ecological transition?

Yifei Li — Chinese diplomats are very much driven by this idea of seeing the Chinese economic approach successfully replicated in other parts of the world like Africa and South America. The Chinese state wants to be a global leader in environmental protection. Under Trump, the US dismantled much of the environmental apparatus. China seems very eager to fill that void. But if it wants to live up to its full potential as a global leader, China must learn to listen to non-state actors. It needs to learn to be sensitive to alternative views of development, and to concerns that may or may not align with the urban-centric developmental vision that seems to be so deeply entrenched in the Chinese state.

Could you tell us more about non-climate environmental impacts in China?

Judith Shapiro — Only looking at carbon neglects many other kinds of environmental impacts. The Chinese mega-dams, for instance, have enormous repercussions on all kinds of ecosystems. Sometimes, with the urgency of the climate crisis, we forget that there are other envi-

ronmental issues at stake too.

Yifei Li — One of the most central insights of environmental studies is that everything is connected. We cannot separate activities like corn or soy monocultures from the wider system that gives rise to them and the damage they inflict on other parts of the ecosystem. Whether it is a forest, a marine ecosystem, or even an urban ecosystem, any project should be sensitive not only to long-term ecological impacts but also to the impacts that may not seem immediately apparent. Take the Three Gorges Dam, for example: concerns were already being voiced when it was being constructed, even before many of the ecological consequences had been predicted. It's only after ten, twenty years that we're beginning to appreciate the long-term loss of sedimentation, including what this means for downstream communities. This wasn't known before, simply because humans had never experienced a similar impact on that scale. But today, we know for a fact that because of the Three Gorges Dam, the city of Shanghai is not receiving enough sedimentation, causing it to be slowly washed away into the East China Sea because ocean water is salty and erosive. Ecological consequences will take a very long time to manifest. If we aren't careful now, the consequences can be very costly further down the road.

Is China investing in adapting to the current effects of climate change? How big a priority is this for the Chinese government?

Yifei Li — It's a huge priority. The city of Shanghai where I was born and raised is at risk of experiencing serious adverse climate events if the sea level continues to rise. Top leaders are fully aware of such dangers and they are investing in a seawall comparable to the one in Venice. At the same time, Shanghai has invested in more than 600 pumps on its waterways to pump out water and limit impacts on human settlements in case of a storm. The city also invests in embankment reinforcement projects all year long. This is an ongoing struggle: Shanghai is the most economically important metropolitan center for the Chinese economy. They simply cannot afford to lose it to climate change. But it is striking that there are these huge efforts to make Shanghai climate resilient, while at the same time the Chinese economy continues to emit carbon and all kinds of greenhouse gases that make long-term climate prospects seem darker and darker.

Judith Shapiro — Overall, the Chinese state is much more aware of climate change than the public. In general, Chinese people are more concerned about the impact of air or water pollution on their public health. Even among the highly educated, climate change often seems like an abstract concern. A few young people are following the example of activists like Greta Thunberg, but ground-level air pollution feels much more urgent when everyone is

coughing and children can't go out to play.

How do you see international cooperation between Europe and China on environmental grounds, mutual priorities, and projects?

Yifei Li — Environment, and climate in particular, is an area with real potential for partnerships between China and Europe, as well as China and the US. Europe has so much experience with carbon cap and trade for instance, and China seems eager to acquire and act on that knowledge. Also, unlike many of China's Belt and Road partners in Africa and Central Asia, Europe has many strong legal institutions. The European Union's Directorate-Generals for Energy and for Environment both have existing rules with a successful track record. As the Belt and Road continues to take root in countries like Italy or Germany, it will be interesting to see how EU officials can hold Chinese state investors accountable to European law and not to Chinese law. China and its foreign partners don't have overarching legal institutions to govern the Belt and Road projects: all China does is follow the local legal provisions and regulatory codes. The real win-win scenario that could materialise would be if Belt and Road projects turn out to be beneficial to Europeans while still making sense to Chinese economic state investors. As of now, all we see is China partnering with countries like Sri

Lanka, Djibouti and Tanzania, in political contexts where the local regulatory regime may be corrupt, minimal, or just generally ineffective. So, the EU will be a key test for the Belt and Road.

Judith Shapiro — Commentators have suggested that US- China relations have been so damaged by Trump's trade war that climate policy will be about competition rather than cooperation moving forward. I don't agree that it must go this way. Looking back to the 2014 APEC summit, Barack Obama and Xi Jinping committed to work together on climate. These issues can be seen as wedges to renew a disrupted partnership. As someone who has devoted her life to the US-China relationship, I would like to see whether we can hold onto the possibility that the US and China can work closely on this issue. That's not to say China should be excused for its human rights violations in Xinjiang and Tibet, for example, or the situation in the South China sea - but on climate alone, the US and China have a lot of ground for working together.

Yifei Li — It's not about China and the EU or the US choosing to work together. We are in planetary crisis that is simply too urgent. If we are serious about making sure this planet is humanly habitable, working together is the only option.

Ecological Policy with a Chinese Twist

110

Natural devastation illustrates the crisis of transitions in China. In China, the double-digit, multi-decade miracle of growth has turned into an environmental and health dystopia. An ecological devastation looms over and underpins the crisis of transitions¹, not only on the level of health and society, but also symbolically. It looms in the form of heavy clouds of smog² which settle oppressively over cities. It is a dense fog that obscures the future and suffocates the population. The ecological question looms large in China because natural disasters and environmental troubles are interpreted in a particular political way, based on age-old traditions. These natural events or troubles – floods, droughts, pandemics, earthquakes – are interpreted by a portion of the Chinese population and its leaders as heralding a possible withdrawal of the “Mandate of Heaven.” These disasters can be construed as a harbinger that the ruling dynasty has either disrupted harmony or is unable to maintain it, in which case leaders may find their right to rule imminently revoked. This ecological devastation ultimately underpins the crisis of transitions as the impact of environmental damage is almost limitless and affects all human activities.

An ecological rumbling is spreading among the Chinese population. “The Great Collapse”³ is fueling panic among leaders who fear losing the Mandate of Heaven.

1. The communist regime is facing several transitions, including the rebalancing of its economic growth model (called the “new normal”) towards domestic consumption and less towards exports (a soft landing), its move upmarket (in order to avoid the middle-income trap), against a backdrop of aging demographics, rising geopolitical tensions in its vicinity, an open trade war with the United States, and challenges to and even rejections of its “New Silk Roads” initiative.
2. This is the thick brownish haze, resulting from a mixture of air pollutants. Smog is a photochemical formation of ozone. It is a degradation of air quality, mainly through the formation of low-level fog called “smog”. Extreme smog phenomena have been observed in China since the early 2010s.
3. Expression of “Grand Collapsus” succeeding the “Grand soir” used by Pascal Bruckner, in a context not specifically related to China. P. Bruckner, “L'écologie entre panique et sang-froid”, *Le Débat*, vol. 210, n° 3, 2020.

Nevertheless, the Chinese Communist Party (CCP) has identified geostrategic and political opportunities in the rising tide of greening of opinions and values. Nothing can guarantee that Chinese totalitarianism has fully exhausted its potential for metamorphosis – becoming green is just one more. “Ecological totalitarianism” refers to a form of messianic policies which aim to green and completely transform mankind and society through total social control.

The red century⁴ has given way to the green century. Against the backdrop of accelerating climate disturbances and the collapse of biodiversity, it is the recognition of this ecological question which gives the 21st century its green color. It is impossible, however, to understand this green century without taking Beijing into account, which is certainly fond of green, but does not intend to give up the “bright red”⁵ in which the Chinese Communist Party drapes itself⁶.

The 21st century’s red color is not unique to China, however. Governing in the Anthropocene requires building consent for the draconian measures required to limit global warming to levels that preserve the planet’s habitability. Managing situations of voluntary scarcity (in the case of climate change mitigation) or involuntary scarcity (in the case of adapting to its consequences) raises major redistribution issues. The ecological question revives the social question and reintroduces forms of taxation in kind.

To this palette of green and red can be added yellow, which is associated with the lasting legacy of imperial China and with one of the most important places of Maoism’s memory – “the Yellow Land”, where the Long March ended. As a testament to his revolutionary fervor, Chinese President Xi Jinping claims to be a son of “the Yellow Land”⁷ where he was sent as a young man during the Cultural Revolution. With his vision of “ecological civilization”, which he had written into the constitution of the People’s Republic of China, Xi Jinping blends “socialist and Chinese characteristics” with red, green, and yellow.

4. The expression “red century” is sometimes used to refer to the twentieth century. This is notably the title of a book by Jean-Christophe Buisson published in 2019 and subtitled “The Communist Worlds 1919-1989”. J.-C., Buisson, *The Red Century*, Paris, Perrin, 2019. As for the expression “green century” is more recent, but is gaining popularity, especially after the publication by the philosopher Régis Debray of an essay entitled *Le Siècle vert: Un changement de civilisation*, Paris, Gallimard, “Tracts. Grand format,” 2019.
5. A. Ekman, *Rouge vif: l'idéal communiste chinois*, Éditions de l'Observatoire, 2020.
6. *The East is Red* is a political song that was virtually the anthem of the People's Republic of China during the Cultural Revolution.
7. The Yellow Earth is both a place where Mao's Long March ended in 1935, and a term that, for the Chinese, designates a region symbolizing hard work and noble sacrifice. F. Lemaître, F. Bougon, “Xi Jinping, son of the ‘yellow earth’”, *Le Monde*, 30 July 2019.

Defining Chinese political ecology

This “ransacking of nature” is one of the most striking symptoms of the unsustainability of an ultra-centralized, extractive, and productivist political and economic model. Firstly, it is ultra-centralized – which is to say that it operates with a highest to lowest, top down, center out decision-making model, where planning and decision-making powers are concentrated in the hands of a small numbers of people – in this case the Standing Committee of the Political Bureau of the Chinese Communist Party. Secondly, this model is “extractive” because it is based on the unrestricted and unrestrained use of natural resources. Thirdly, it is a “productivist” system which is founded in the unbridled pursuit of economic growth and the systematic drive for industrialization, standardization, volume, and economies of scale. However, structural slowdown in economic growth renders the social contract under which the CCP guaranteed the country’s prosperity in exchange for its hegemony and lack of political pluralism obsolete. It seems difficult to urge the Chinese people to simultaneously get rich – the famous “Get rich!” of Deng Xiaoping⁸ (which remains relevant today) – and to live frugally. This is reflected in President Xi Jinping’s call for “a green and low-carbon lifestyle of moderation and frugality” and “opposition to extravagance and unjustifiable consumption”⁹.

Within this Chinese historical and political context, the Chinese “leap into green” can be described through two concepts. The first is “political judo” which, just like the discipline, implies flexibility – in this case, power’s ability to adapt and adjust. This concept describes a regime’s ability to get out of uncomfortable situations by turning them to its advantage. While the initial calls to make China’s development model greener came from the population¹⁰, isn’t the Chinese central government practicing “political judo” by shifting the pressure to solve the ecological cri-

sis onto the people and the provinces? This new energy, economic, and cultural paradigm could benefit Beijing. It is a unique opportunity to establish a new narrative, to strengthen its global leadership, and to affirm its soft power (lending credence to its theory of a “peaceful rise to power” and even saving humanity). An alternative narrative of scapegoating minorities or foreign powers and promoting a warrior mentality is also possible.

President Xi Jinping has promised to “make China’s skies blue again” and has spoken about a “war against pollution” in publicized settings, including the 19th Party Congress in October 2017¹¹. Cutting pollution is one of the three high priority “tough battles” for China in the years to come (the other two are eliminating poverty and reducing financial liabilities¹²). Premier Li Keqiang has also declared war on air pollution, declaring in September of 2013 that China would use “iron fists” to fight pollution¹³. The Communist regime is combining ecological issues with political stability through its concept of “ecological security”.

President Xi Jinping has called for “willingly and conscientiously accepting the people’s oversight”¹⁴, especially in the area of environmental protection. In the case of China, the ecological crisis, rather than weakening a regime that is cornered or forced to act, could allow its leaders to reestablish the Party’s legitimacy, to perfect its authoritarianism, and to tighten its grip. An ecology which is not superficial will inevitably touch aspects of everyday and private life. The Party could then justify an almost unlimited expansion of political control in the private sphere: food, clothing, travel, leisure, etc. However, “There is a limit to the legitimate interference of the collective” wrote the philosopher John Stuart Mill¹⁵. This already tenuous limit to the legitimate interference of the collective has been further weakened by the fights against the Covid-19 pandemic and against smog, which have more in common than the wearing of masks and are subject to similar restrictions.

Turning an authoritarian regime green only makes it more dangerous. If, as François Godement explains, “the idea of China’s inevitable democratization is the greatest illusion at the end of the twentieth century”¹⁶, another illusion must be dispelled at the beginning of the twenty-

8. Slogan used in 1992 during the great economic reforms launched by Deng Xiaoping.

9. X. Jinping, “*Pushing China’s Development of an Ecological Civilization to a New Stage*”, Qishi, vol. 11, n° 39, 2019. Xi Jinping’s original citation in English: “Green ways of living relate to the basic needs of ordinary people, like food, clothing, shelter, and transportation. We must advocate a green and low-carbon lifestyle of moderation and frugality and oppose extravagance and unjustifiable consumption. We must carry out extensive campaigns to build conservation-minded public offices, engage in activities to promote green modes of transportation, and develop eco-friendly families, schools, and communities”.

10. In particular through numerous demonstrations in opposition to the installation of polluting projects. This social discontent sometimes erupts in violence. This was the case, for example, during the demonstrations against the installation of a paraxylene factory in Kunming in May 2013. On the subject of the uprising of local populations against polluting projects, see for example M.-H., Schwoob, “L’éveil vert de la société chinoise?”, *Écologie & politique*, vol. 47, no. 2, 2013. Discontent is also expressed on the Internet. An oft-cited example is the success and political reaction to a documentary on smog titled “China’s Haze: Under the Dome,” it was an investigation published in February 2015 and made by journalist Chai Jing. It was viewed 155 million times in 24 hours (300 million views in total) and initially praised by the Chinese Ministry of Environment, before being censored. In another example, a poem entitled *I long to be King* reminding us that smog is a major cause of cancer, written by a Chinese thoracic surgeon, went viral in January 2017

11. People’s Republic of China, Progress Report of Xi Jinping to the 19th CPC National Congress (18 October 2017), *Winning the Decisive Victory of Fully Building the Middle-Income Society and Triumphant Chinese-style Socialism in the New Era*, 2017.

12. Ibid.

13. Reuters Staff, “China to “declare war” on Pollution, Premier says”, Reuters, 2014.

14. X. Jinping, *China’s Governance*, vol. 2, op. cit. p. 32. Speech entitled “Carrying on and Properly Implementing the Soul of Mao Zedong’s Thought (26 December 2013).

15. J. S. Mills, *De la liberté*, Gallimard, Folio, 1990.

16. P. Saint-Paul, interview with F. Godement, “Xi’s China has taken an authoritarian turn”, *Le Figaro*, 2019.

first century: the greening of China's economy and society will not spontaneously lead to the country becoming democratized and the advent of the "fifth modernization"¹⁷. The ecological issue is having a retroactive effect on institutions and is upsetting the very conditions of politics¹⁸.

The manner in which the CCP is dealing with the ecological crisis has implications for the nature of the regime itself. However, it seems inappropriate to speak of altering or reforming the regime, as the greening of the economy and society reinforces its "democratic centralism" and makes it more intrusive. There are certain intrinsic elements to the ecological issue that promote or embrace the CCP's authoritarian views and practices. The ecological question indeed relies on physical elements within a category of imbalance. It has an eminently tangible nature (geological or chemical issues) and are measured and expressed in flows and stocks (quantifiable in tCO₂eq per person, per trip, per manufactured product). It can be captured by figures at the risk of becoming blind. Nearly everything has carbon consequences and must be measured, recorded, and analyzed. Flows are thus related to stocks and vice versa. They are also intrinsically linked to energy and affect the health of individuals (disrupting living conditions or even survival) and touch all aspects of human life, including the most private. Science still has a limited understanding of the ecological question – it is a source of uncertainty and anxiety and collides with the cognitive limits of ordinary people. It is largely unpredictable (with feedbacks, threshold effects, or acceleration risks) and carries a potential for anxiety and panic. These intrinsic elements are identifiable in ecological authoritarianism¹⁹.

17. This expression refers to the name given to a poster stuck on a wall, signed by the hand of Wei Jingsheng, on 5 December 1978. It was a call for individual freedom and the establishment of true democracy. Today, the expression means the democratic modernization of institutions, including real political pluralism and freedom of opinion and expression.

18. The ecological question upsets the nature of power, political institutions and especially the relationship between the governors and the governed. Democracy, in the sense of a regime or a political society and not only of an institutional system, is for example disturbed. The common rules and norms that societies adopt in order to orient and structure human behavior and interactions are changing, particularly through establishing limits. Organizations - parliaments, administrations, regulators, private companies, associations, etc. - Organizations - parliaments, administrations, regulators, private companies, associations, etc. - must now operate or deal with the ecological constraint, in particular with the attitude towards the life of their citizens or constituents resulting from the Anthropocene. They proceed in different ways, in symbolic registers or more directly in public policies, by means, for example, of direct controls or incentives to reshape human behaviors in order to reduce their carbon footprint.

19. Its distinctive features are, for example: an enlightened vanguard that is the only one capable of solving the problem (an ecological Politburo or a committee of experts); instrumentalization of science to establish its power and its decisions (refuge and irresponsibility behind the implacability of figures); rejection of responsibility for failures and disasters on past generations, on the other, or on political opponents; mono-causal explanation of all events: total political irresponsibility in the face of accidents and disasters; fixation of the hierarchy of values and behaviors, identification of deviants or revisionists; measures to reduce GHG emissions imposed unilaterally and without deliberation (while ignoring social and redistributive issues, in particular the sharing of scarce resources in the event of suffered or administered shortages); permanent state of emergency: suspension of rules framing state action; confusion between civil and military aspects (militarization of minds

Given China's role in globalization, this metamorphosis is not limited to the CCP but also affects global energy, climate, and politics. By "going green," China could prevent ecocide, surpass the United States in economic power and influence, and also fundamentally transform globalization and ecological practices.

The "ecological panic", a genuine or opportunistic concern?

The second concept we propose exploring is that of "ecological panic". This concept is inspired by the work of the American historian specializing in the history of Central and Eastern Europe and the Holocaust, Timothy Snyder²⁰. Panic serves as a kind of "oil" or "lubricant" in political judo. It allows us to avoid viewing the shift or the ecological conversion of CCP leaders solely in terms of political opportunism. Introducing the notion of political panic allows us to dismiss the Manichean idea of manipulating the masses – who have been rendered as malleable as clay – by the Chinese communist leaders²¹. This view avoids the pitfall of exaggerating the leaders' intentions. On the contrary, it assumes that they can be "overcome" or "stricken" with panic, just like the rest of the population. Mobilizing the irrefutable alibi of the ecological crisis, if it translates into greater Party control, can be quite sincere.

Xi Jinping seems genuinely concerned about ecology and the environmental crisis that is affecting China. Reports indicate that the first thing the supreme leader does in the morning is to inquire about pollution levels²². A certain amount of distance is required to appreciate such information. Certainly, Xi Jinping wants the population to know that his first concern upon waking up is to check pollution levels. It is difficult to gauge a political leader's honest beliefs, but there is evidence that the communist supreme leader's concern for the environment is genuine. Xi believes that "human activities must respect, adapt to, and protect nature, or else human beings will suffer its retaliation; this is an unbreakable law"²³. The communist leader's ecological vision is underpinned by a political history of ecological issues. His speeches are imbued with and punctuated by references to historical episodes of political collapse or economic decline caused by man's destruction of nature. Xi Jinping considers that "With his-

and of the fight against climate change), especially in the organization of relief efforts (omnipresence of the military celebrated for its assistance to victims); surveillance of individual ecological efforts and disappearance of the notion of privacy and confidentiality.

20. T. Snyder, *Terre noire : l'Holocauste, et pourquoi il peut se répéter*, Gallimard, Bibliothèque des histoires, 2016.

21. L. Willy Wo-Lap, *The Fight for China's Future : Civil Society vs Chinese Communist Party*, Routledge, 2019.

22. AFP, "China's Xi Says he Checks Pollution First Thing Every Day" Daily Mail, 2014.

23. X. Jinping, *China's Governance*, vol. 2, op. cit, p. 490. Speech titled "Promoting the Establishment of Ecological Living and Development" (26 May 2017) from Key Points of Speech at the 41st Study Session of the Political Bureau of the 18th Party Central Committee.

tory as a mirror, we can understand the rise and fall of a state”²⁴, citing the environmental degradation, particularly desertification, that led to the decline of ancient Egypt and Babylon. He also cites Chinese examples - the once glorious and lush kingdom of Loulan engulfed by desertification, or the Hexi Corridors and Loess Plateau whose fall was triggered by deforestation caused by agriculture resulting in economic decline. He points out that the shift in economic poles to the east and south since the middle of the Tang Dynasty (618-907) was largely the result of environmental changes in western China. For Xi Jinping, ecological issues have considerable transformative power, “changes in the environment have a direct impact on the rise and fall of civilizations”²⁵.

The ecological crisis provides an even greater opportunity for the Party to strengthen its grip because its leading officials have a genuine sense of urgency to act swiftly and decisively. The more firmly they believe and convince themselves of this, the more politically corrosive the ecological issue will become for the freedoms and peace between China and its neighbors.

The great leap into green?

It is the combination of these two concepts of “political judo” and “ecological panic” that supports the hypothesis of an unstoppable mechanism similar to the Great Leap²⁶. Forward, which could lead, if not to famine, at least to involuntary mass murder and the collapse of institutions. This chain of events could be fatal not only for the environment – for the life cycle assessment of China’s green advances is often mixed, with China displacing ecological problems more than it solves them²⁷ – but also for civil liberties. Panic suspends judgment, which can have devastating effects in regimes combining concentration of power, and cult of personality, and terror. Panic is above all movement. Each failure or denial of the experiment feeds the vicious dynamic even more and leads to greater control. The CCP’s performative approach to truth – the hammering and learning of slogans and speeches shape

it – as well as its relationship to statistics and planning, could trap local officials in charge of implementing carbon budget cuts into the same falsification of reality that peasants experienced during the Great Leap Forward. Xi Jinping’s call to move “decisively towards clean winter heating in northern China”²⁸ to stop episodes of “airpocalypse” in Beijing resulted in a freezing winter for rural residents in northern China²⁹ whose coal-fired boilers were destroyed by local Party officials eager to implement orders from above and were less concerned about the availability of affordable alternative heating solutions for low-income households.

Any criticism is dead in the water if the Party benefits the next generations who have a commitment to history³⁰ (the fulfillment of the new Chinese Dream and the Two Centuries goal)³¹. For President Xi Jinping, “advancing towards a new era of ecological civilization and building a beautiful China are important parts of realizing the Chinese Dream of the great renewal of the Chinese nation”³². The ecological issue is therefore at the heart of the narrative of national rebirth told by the Supreme Leader. Chinese Communist officials could therefore withdraw their statements and decisions over controlling the present by arguing that they are only accountable to the future and achieving the Chinese Dream as envisioned by the Supreme Leader. Their ecological spiritualism would act as a shield. Ecological civilization may further immunize the CCP against both experience and argument. The slightest denial of direct experience will be treated as a failure of implementation, which will justify the strengthening of supervision and control bodies, pushing the ambition of total control over living conditions even further. Strengthening the technological system and tracking individuals will consequently be presented as necessary. This total empowerment of the future ecological civilization replaces the communist aim.

The convergence of a number of factors lends credence to the potential of an authoritarian, or even totalitarian, ecology. At the root of a successful ecological civilization,

24. “With history as a mirror, one can understand the rise and fall of a state. The reason why I have repeatedly emphasized the importance of taking environmental issues seriously and handling them properly is that China’s environmental capacity is limited, our ecosystems are vulnerable, and we have still not achieved a fundamental reversal of environmental conditions that cause heavy pollution, significant damage, and high risk.” X. Jinping, *Pushing China’s Development of an Ecological Civilization to a New Stage*, Qiushi, vol. 11, n° 39, April-June 2019.
25. “The natural environment is the basis of human survival and development, and changes to it directly impact the rise and fall of civilizations”.
26. The Great Leap Forward was Mao Zedong’s first attempt to move away from the Soviet model. This economic, social and political program implemented from 1958 to 1960 turned out to be a terrible fiasco for the whole population, which suffered from 1958 to 1962 the “Great Chinese Famine”.
27. Carbon and pollutant leakage are caused by the internationalization of Chinese companies and the New Silk Roads initiative. Part of China’s strategy to reduce excess industrial capacity is the “internationalization” of its brown industries (in effect, their offshoring). For example, since China restricted commercial logging, it has turned to Russia and Indonesia and imported huge quantities of wood to meet the demand of its construction and furniture companies, accelerating deforestation there.

28. X. Jinping, *La gouvernance de la Chine*, tome 1, Éd. en Langues étrangères, 2014.
29. On the relations between rural residents and Party officials around the ecological issue, see for example the following survey on rural activism. M. H. Hansen, & Z. Liu, “Air Pollution and Grassroots Echoes of ‘Ecological Civilization’ in Rural China”, *The China Quarterly*, vol. 234, 2018.
30. By invoking future generations, or deadlines such as 2035, Xi Jinping could further shield his actions from criticism. The CCP is at the service of the people, this claim is presented as irrefutable. Governing in the name of future generations makes it possible to accept all possible controls, sacrifices or violence. To accept accountability only to future generations is to abolish politics.
31. The “two centenaries” goal is at the heart of the CCP’s agenda and ideological discourse. It is to “complete the comprehensive construction of the middle-income society” by the centenary of the founding of the CCP in 2021 and to make China the world’s leading country by 2049, the centenary of the People’s Republic of China.
32. X. Jinping, *China’s governance*, vol. 1, Foreign Languages ed. 2014. Speech titled “Let’s Leave Blue Skies, Green Earth, and Clear Water for Future Generations” (18 July 2013).

we find extreme levels of pollution and destruction of biodiversity which create the conditions of ecocide and provoke ecological discontent among the population, particularly among the middle class who are desperate for clear skies. The regime finds “good reasons” to blame local officials (an opportunity to bring the provinces to heel and channel popular discontent), or to denounce the West for the perverse influence of its productivist model (blaming Western spiritual and political pollution). Added to this is the Chinese political tradition which views the occurrence of natural disasters as a possible loss of the Mandate from Heaven. This deeply rooted traditional thinking leads to the communist core leadership’s survivalist adherence to the ecological emergency. The ecological issue also holds significant economic opportunities, especially for breaking into new technological sectors. Beijing is working to encourage Chinese companies to move into the “low-carbon” sectors of tomorrow’s economy, such as electromobility. The anticipated benefits of climate leadership in terms of soft power are also important as Beijing hopes to counter its reputation and fill the void left by the United States under Donald Trump’s presidency.

The concept of ecological civilization also reflects a feeling of racial or civilizational superiority, (Chinese millenarianism and the desire of the Hans to civilize ecologically, i.e., to make ethnic minorities more Chinese under the guise of ecology). Hiav-Yen Dam and Sébastien Scotto di Vettimo refer back to the origins of the term ecological civilization (*shengtai wenming*) used in 2007 by President Hu Jintao. They explain that the term *wenming* can be translated as “civilization”, “civilized”, or “modern”. According to them, the term “carries a prescriptive ideology aimed at changing the behavior, moral attitude, and lifestyle of Chinese citizens”³³. This concept fits perfectly with Xi’s vengeful nationalism (his plan for “national rebirth” and undoing the humiliations inflicted by unbalanced treaties). The demand for climate justice could justify a “Malthusianism for the sake of others”, using the principle of common but differentiated responsibilities. Ecology is also fertile ground for the deployment of intrusive technologies (applications on smartphones, sensors, social ratings, or facial recognition cameras) allowing for a ubiquitous control of the “communist green way of life”³⁴. Finally, the arbitrary system of lifetime liability for public officials for environmental crimes could create a green terror. Everything, or nearly everything, points to the possibility of green totalitarianism. Add to this mix the cult of personality surrounding President Xi Jinping, which is built on his green credentials (his early green

record and stance in his career as a local official), a propaganda and iconography of the shovel where the President participates in reforestation activities, or the development of foundational concepts (“the history of the city of Anji”³⁵ and the “Two Mountains theory”).

President Xi Jinping is drawing “red lines for environmental protection”. He wants to build a strong environmental protection corps and to encourage citizen river monitoring or reforestation brigades. He urges “developing ecological families, schools, and communities”³⁶. In the event of environmental violations, he calls for no leniency and no exceptions. In a distinctively repressive vein, he calls on Party officials to “never let our institutions and regulations become toothless tigers”³⁷. Despite communist democratic centralism, Chinese environmental policy is not an ecology without the people; on the contrary, “no one can stand aside and choose to criticize from a distance rather than participate”³⁸. Alice Ekman explains that “the Party therefore expects individuals to be positively and meaningfully engaged in the service of the community, the Party, and the nation, beyond their individual preferences, aspirations, and freedoms”³⁹. Xi is explicit on the subject: “the building of ecological civilization is closely linked to each individual, who must be both a supporter and a promoter”⁴⁰, and the morality of society’s collective participation must be established. Enthusiasm is encouraged through competitions, events, and even national campaigns. One example is the “Beautiful China” campaign, which Xi Jinping sometimes describes using the term movement (*yundong* in Chinese), a word which was used during the Maoist period in connection with the Long March or the Hundred Flowers movement.

The public is thus directly involved in the “surveillance of all by all” in a form of ecology that can be reduced to flows and stocks, embodied in Xi Jinping’s quotes learned by heart, and scored. The CCP is in search of “a consistency uniting economic, social, and ecological performance”⁴¹. Yet producing this consistency unifying these outputs would appear to be the sole responsibility of the Communist Party. Confirming the CCP’s stated premise of “political judo”, Xi Jinping argues that in order to solve the environmental crisis “we must fully exercise the political strength of the Party leadership and Chinese socia-

33. H-Y. Dam, S. Scotto di Vettimo, “Chapitre 8. Entre réconciliation avec la nature et ‘civilisation écologique’. Comment penser l’Anthropocène en Chine?”, in R. Beau et C. Larrère (dir.), *Penser l’Anthropocène*, Presses de Sciences Po, Collection académique, 2018.

34. [ndlr] On this subject, see the article of S. Monjon and E. René titled “The New Tools of Environmental Governance in China: Top Down Control and Environmental Credit”, page 127 and that of F. Cugurullo titled “‘One AI to Rule Them All’: the Unification of Chinese Urban Governance under Artificial Intelligence”, page 123.

35. This previously highly industrial and polluted city is now presented by the Chinese official media as a kind of earthly paradise. Xi Jinping is said to have formulated his “Two Mountain Theory” for the first time and to have uttered the now famous phrase “clear waters and green mountains are the real treasures”.

36. X. Jinping, *La gouvernance de la Chine*, tome 1, op.cit.

37. Ibid.

38. Ibid.

39. A. Ekman, *Rouge vif : l’idéal communiste chinois*, op.cit.

40. X. Jinping, *China’s Governance*, vol. 2, op. cit, p. 493. Speech titled “Promoting the Establishment of Ecological Living and Development” (26 May 2017) from Key Points of Speech at the 41st Study Session of the Political Bureau of the 18th Party Central Committee.

41. X. Jinping, *China’s Governance*, vol. 1, op. cit. p. 252. Speech entitled “Toward a New Era of Socialist Ecological Civilization” (24 May 2013).

list system which can provide the necessary resources to take on immense tasks⁴². The CCP General Secretary proclaims that in the “relentless and tireless fight for the environment, it is essential to strengthen the CCP’s leadership.”

What constitutes “good” ecology

While China’s material enrichment has been considerable, it is important to not lump the ecological issue into a debate on efficiency. A former expatriate in Beijing involved in sustainable development in China says, “China can move forward at the press of a button. It puts all the means in place to succeed. Its authoritarianism allows it to mobilize society on a massive scale⁴³. The picture is not that clear. And even so, politics is not about efficiency alone and must be viewed in the long term. Rather, it seems that the ecological issue implies a transformation that is far-reaching, lasting, and freely agreed upon. Unilateral and comprehensive management of decarbonization is not capable of resolving the ecological crisis. The great reformist impulses, with their Manichean and exonerating dimensions, often cause imbalances. Ignoring collective intelligence and the virtues of democratic decentralization risks major pitfalls. Top-down and authoritarian environmental policies induce guilt in the poorest and disempower officials in charge of implementing them. These policies open the door to fraud and corruption and are more likely to be unfair and poorly accepted.

While technological breakthroughs are crucial to the greening of economies, the transition to sustainable development is a more in-depth process. Introducing “green” or “clean” technologies and enacting stricter regulations is not enough. The shortcomings of a strictly scientific ecology are well known⁴⁴. An ecology which liberates mankind must be designed as political self-limitation. The principal virtue or benefit of ecology is to question the ends of progress and to redefine the notion of limits. Cornelius Castoriadis proposes a definition of ecology that is far removed from any romanticism or mystification of nature. He writes: “ecology is not the ‘love of nature’: it is the necessity of human beings’ self-limitation (that is to say, of true freedom) in relation to the planet on which, by chance, they exist, and which they are destroying”. The liberal hypothesis of society’s ecological redesign is that self-determination can lead the way to self-limitation. In this sense, ecology does not necessarily consist of extending controls and constraints but can also mean the diffusion of the idea of restraint throughout society

and its appropriation by the social body. Self-restraint means foregoing and prioritizing certain opportunities and consciously abstaining. It is not necessarily a dismantling of certain ways of life. If taming social violence is at the heart of the “civilization process,” the next step in this process is to contain the violence that humans exert against nature. In order to avoid conflicts over the division of resources, violence among humans was previously redirected towards the environment in a process of accumulating those resources. Productivism is a way to mitigate conflicts of scarcity. But ecology takes on the role of reminding people “that everyone cannot do whatever they want; we must limit ourselves⁴⁵. Castoriadis proposes an explanation of ecology and his philosophical thinking on autonomy: “Autonomy – true freedom – is the necessary self-limitation not only in the rules of intrasocial conduct, but in the rules that we adopt in our conduct towards the environment⁴⁶. It would thus be a question of self-limitation in the rules that we adopt, by which we mean non-heteronomous rules, i.e. not handed down or told by religion, tradition, a single party, or a supreme leader. “Organizing certain forms of non-intervention is obviously governing, but it is governing in a different way than directing⁴⁷ explains Gil Delannoi. Ecological transition requires the support and participation of citizens, both in the deliberation and design of measures, as well as in their application, enforcement, and oversight of their implementation. However, including a billion people in such deliberations could prove to be complicated. The Communist regime relegates the Chinese public to the latter stages – oversight and implementation – and excludes them from the initial stages. This is not a new issue. Faced with these challenges concerning the appropriate scale of decision-making and the practicality of participatory democracy, the traditional route that favors territorial democracy seems to be reinforced by the intrinsic environmental benefits of “localism” and reduced imports. As a result, greater self-sufficiency automatically narrows the possibilities of consumption and consequently reduces the associated emissions of greenhouse gases.

Planetary limits do not exist independently (which does not negate the existence of biodiversity tipping points or feedback loops); their definition requires the intervention of human beings, i.e. the judgment and deliberation of a certain number of people, depending on the political system. These limits or manners of organizing an ecologically responsible society are not detectable or identifiable through scientific observation. They are defined in terms of tolerance thresholds for environmental degradation that are commonly agreed upon, sometimes tacitly through collective inaction, and that science sheds

42. X. Jinping, “Pushing China’s Development of an Ecological Civilization to a New Stage”, *Qiushi*, vol. 11, n° 39, April-June 2019.

43. G. D’Allens, “La Chine, une inquiétude pour le climat mondial”, *Reporterre*, 2019.

44. One example is the disproportionate and self-serving expectations placed on carbon dioxide capture and storage technologies. More generally, faith in technical progress and energy efficiency gains are often neutralized because they are reallocated to other activities, or allow for increased consumption (“rebound effect”).

45. C. Castoriadis, “*La force révolutionnaire de l’écologie*”, Journal published by Bureau des élèves de l’Institut d’études politiques de Paris, 1992, reprinted in *La société à la dérive*, Paris, Seuil, 2005.

46. Ibid.

47. G. Delannoi, “*La liberté est-elle négative ?*”, *Commentaire*, vol. 3, n° 115, 2006.

light on, but in no case can it set.

Conclusion

Caring about the global commons, especially climate, requires studying China, which polarizes global ecological problems and hopes because of its demographic and carbon weight. Additionally, in Xi Jinping's words, the country intends to take "the wheel of climate action in international cooperation". The implications of this statement, made in 2017, may not have been fully appreciated at the time. At the very least, we should know the possible destinations of an "ecological journey" whose path is determined by the CCP, and which the West would be

reduced to simply being the passenger. For Xi Jinping, the creation of an ecological civilization must proceed smoothly in order for Chinese-style socialism to win a decisive battle in the ideological competition with the West. If Chinese-style ecology proves or is perceived to be effective in combating climate change, the authoritarian mold in which it is forged may gain additional prestige and legitimacy. Confronted with the magnitude of future environmental disturbances and the unrelenting feeling of powerlessness resulting from the inertia of climatic phenomena, public opinion may be enticed, not to abandon or shun the liberal political model, but to increasingly borrow from Chinese authoritarianism.



Stéphanie Monjon • Scientific Director of this issue, Professor and Researcher, Laboratoire d'Économie de Dauphine, Université Paris Dauphine - PSL University

Léa Boudinet • GREEN Co-editor-in-chief

The State of China's Environment: What Has Changed in the Past Few Years?

In 2014, the Chinese Prime Minister Li Keqiang announced that the country would go to “war on pollution with the same determination as the one waged against poverty” and, in 2017, President Xi Jinping declared that he wished to make the Chinese nation an “ecological civilization” before members of the Communist Party Congress. Given these extremely strong pronouncements, it is only fair to wonder what progress has been made since then.

A war against pollution implies reducing all manner of contaminants (emissions, sewage, garbage, etc.) in various environments (air, water, soil). The term “environment” covers a wide variety of environments and ecosystems, and the list of pollutants is particularly long: fine particles, sulfur dioxide (SO₂), nitrogen oxides (NO, NO₂), CO, ozone (O₃), plastic particles, chemical pollutants, lead, cadmium, arsenic, hydrocarbons, benzene, volatile organic compounds (VOCs), nitrates, etc. Protecting the environment therefore requires a whole host of actions to reduce all of these contaminants and ensure the good health of the various ecosystems that are essential to life. Assessing the state of a country's environment requires implementing numerous oversight systems, processing the data they produce, analyzing, and synthesizing this data. Authorities can then choose to publish this information in a more or less comprehensive manner. However, despite declarations of a new environmental governance based on greater transparency and data disclosure¹, assessing the condition of various environments in China remains difficult. In addition to the falsification of environmental data that is still regularly discovered in the country², the data is often incomplete, and it is often impossible to monitor it over a period of several years.

1. [ndlr] See the article of S. Monjon et É. René titled “*The New Tools of Environmental Governance in China: Top Down Control and Environmental Credit*”, page 127.

2. [ndlr] Ibid.

In this article, we have brought together several sources offering different insights into the recent state of the environment in China. Far from being exhaustive, the assessment presented here provides some insights into the environmental crisis that the country is still facing.

First evaluation by means of an aggregated index

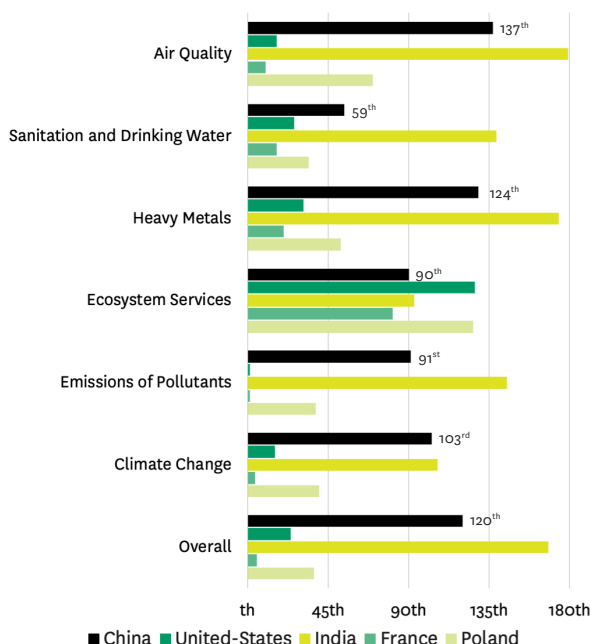
The Environment Performance Index (EPI³), developed jointly by the Yale Center for Environmental Law & Policy and the Center for International Earth Science Information Network (CIESIN) at Columbia University's Earth Institute, provides an initial comparison of 180 countries. The 2020 Index ranks China 120th, based on data from 2017 or 2018. It includes 32 indicators in 11 categories: air quality⁴, sanitation and drinking water, heavy metals⁵, waste management, biodiversity and habitat, ecosystem services⁶, fisheries, climate change⁷, emissions⁸, water resources, and agriculture. Figure 1 shows the rankings of China, France, India, and Poland for some of the index categories.

While this environmental index has limitations, particularly in terms of data availability and reliability⁹ which may lead to questionable choices in the calculation of an indicator, China's overall position is quite weak: the country is ranked 120th, *i.e.*, last in the second of the three tiers. China's results nevertheless vary according to the category in question. While China is ranked in the top third for drinking water quality, it is far behind the United States or France in other categories: air quality (137th), emissions (91st), and climate change (103rd).

In the remainder of this article, we examine a small number of environments – air, surface water, and soil – in more detail based on data published by authorities in China.

3. Z. A. Wendling, J. W. Emerson, A. de Sherbinin, D. C. Esty, et al, 2020 *Environmental Performance Index*, New Haven, CT: Yale Center for Environmental Law & Policy, 2020. Since 2006, this indicator is published every two years.
4. The “air quality” category of the 2020 EPI contains 3 indicators: population exposure to PM_{2.5} (55%), household use of solid fuels (40%), population exposure to ozone (5%).
5. The “heavy metals” category only considers the population's exposure to lead.
6. The “ecosystem services” category contains 3 indicators: loss of forest area (90%), loss of grassland area (5%) and loss of wetland area (5%). These 3 indicators are calculated by taking averages over the last 5 years and comparing the areas to their level in 2000 for forests and 1992 for grasslands and wetlands.
7. The “climate change” category contains 8 indicators including: the rate of increase of CO₂, CH₄, NO₂ emissions and the rate of increase of the greenhouse gas intensity of GDP.
8. The “pollution emissions” category contains 2 indicators: the rate of increase of SO₂ and NO_x emissions.
9. Extract from EPI 2020 report: “better data collection, reporting, and verification across a range of environmental issues are urgently needed.” Wendling, Z. A., Emerson, J.W., de Sherbinin, A., Esty, D.C., et al. (2020). 2020 Environmental Performance Index.

FIGURE 1 • RANKING OF CHINA, THE UNITED STATES, FRANCE, INDIA AND POLAND IN DIFFERENT EPI 2020 CATEGORIES



Air pollution in China

In the early 2010s, images of the “airpocalypse¹⁰” left their mark on international public opinion, and air pollution is certainly the phenomenon which comes to mind when thinking about pollution in China. However, the situation is not the same throughout the country. Air pollution is a relatively localized phenomenon and can be generated by different types of air pollutants; some air pollutants remain close to the sources that emitted them while others are carried by the wind over dozens (or even hundreds) of kilometers, which can lead to the degradation of air quality in areas that are not responsible for this pollution. Other air pollutants are called secondary pollutants, *i.e.*, they are not directly released, but are formed when other pollutants, called primary pollutants, react in the atmosphere. For example, ozone (O_3) is formed from hydrocarbons (HC) or volatile organic compounds (VOC) and nitrogen oxides (NO_x) that react in sunlight, and NO_2 is produced as a result of a reaction between NO and oxygen. Understanding the how and why of air pollution in a city or region requires a detailed knowledge and analysis of the different types of emissions generated within a territory, their movements, and their possible reactions with the atmosphere.

In China, the assessment of ambient air quality by

the Ministry of Ecology and Environment (MEE) is based on measuring the concentration of 6 pollutants: PM_{2.5}, PM₁₀, SO₂, NO₂, O₃ and CO¹¹. An individual score is given for each pollutant; when the concentration of pollution exceeds a certain threshold, the score increases. The final air quality index is the highest of these scores.

In the 2020 EPI, the “air quality” category contains 3 indicators: population exposure to PM_{2.5} (55%), household use of solid fuels (40%), and ozone exposure (5%). China is ranked 137th, which is a very bad ranking given the authorities’ efforts on this matter for several years¹².

In 2017, the MEE published a ranking of 74 Chinese cities¹³: for 75% of the cities, the largest source of air pollution comes from PM_{2.5}, but the worst ranked cities (Haikou, Lhasa, and Zhoushan) are due to O₃¹⁴. Therefore, depending on the city, the diagnosis can significantly differ. The annual reports published by the MEE make it possible to track the evolution of these 6 pollutants between 2015 and 2019 in Shanghai and Beijing and their surrounding areas¹⁵. For comparison, the thresholds recommended by the World Health Organization (WHO) are included.

The figure shows significant differences between locations, pollutants, and 5-year trends. For example, ozone pollution in Beijing has slightly decreased (-4% from 2015 to 2019) but has increased by about 13% in the Beijing-Tianjin-Hebei region. For some pollutants, such as SO₂ and NO₂ emissions, a decrease has been recorded: concentrations show a clear improvement in all 5 areas with an average decrease of 53% and 23% respectively.

10. “The air quality in China has worsened in recent decades. From 1960 to 1979, the number of fog and haze days during winter in China showed a gradual upward trend. Although it was generally stable it grew rapidly since 2000”. H.-J. Wang, H.-P. Chen, “Understanding the recent trend of haze pollution in eastern China: Roles of climate change”, *Atmos. Chem. Phys.*, 2016.

11. Rohde R. & R. Muller, “Air Pollution in China : Mapping of Concentrations and Sources”, *Plos One*, 2015.

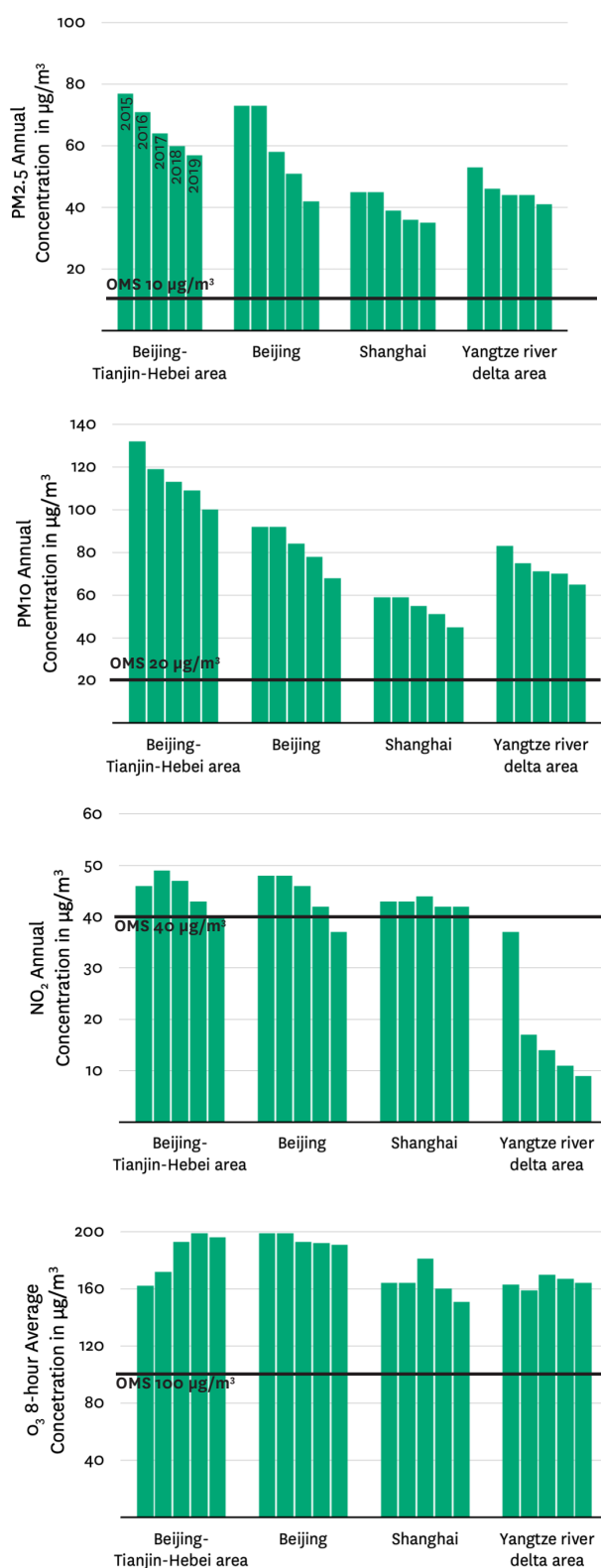
12. For example, in 2014, Prime Minister Li Keqiang declared “war on pollution” at the annual CCP conference. The year 2013 saw a significant strengthening of China’s air quality improvement policies with the launch of the National Air Quality Plan which set reduction targets to be achieved by 2017, including a minimum 10% reduction in all urban areas in PM₁₀ concentrations compared to 2012 levels. Additional measures have been implemented in these areas including a ban on the construction of coal-fired power plants, a reduction in the number of cars on the road, and a reduction in industrial capacity for steel and iron production. M. Greenstone, P. Schwarz, *Air Quality Life Index - Is China winning its war on pollution?* Energy Policy Institute at the University of Chicago, 2018.

13. These 74 cities are all larger than a prefectural city (minimum 250,000 non-rural inhabitants according to Chinese standards) and received special monitoring. These cities are specifically located in three densely populated regions of China which are the Beijing-Tianjin-Hebei region (one of the most polluted regions of China in 2013), the Yangtze River Delta, and the Pearl River Delta. These three regions were specifically targeted in 2013 by the National Air Quality Plan.

14. O₃ is formed by the reaction of NO_x produced mainly by road traffic and VOCs produced mainly by industrial activities, solvents and paints, and road traffic. www.airparif.asso.fr/lozone, accessed on 25/02/2021

15. Guangzhou City and the Fenwei Plain region were not included because data is only available for two years during the 2015-2019 period.

FIGURE 2 • CHANGES IN CONCENTRATION OF THE 6 POLLUTANTS INCLUDED IN THE AIR QUALITY INDEX FOR 2 CITIES AND 2 REGIONS IN CHINA (2015-2020)¹⁶



16. Sources : Ministry of Environmental Protection, 2015 and 2016 Report on the State of the Environment in China, The People's Republic of China. Ministry of Ecology and Environment, 2017, 2018 and 2019 Report on the State of the Ecology and Environment in China, The People's Republic of China.

The burning of coal is still the biggest source of air pollution in China, especially PM_{2.5}, SO₂ and NO_x¹⁷. Since the late 2000s, coal-fired power plants have been equipped with desulfurization and denitrification systems for their flue gas during construction and renovation¹⁸. These systems reduce SO₂ emissions by more than 90%, but only a fraction of NO_x and fine particles emissions. Yet coal-fired power plants are still being developed on a massive scale and at an unprecedented rate worldwide. As of February 2021, China has 247 GW of coal-fired power plants under development¹⁹. While desulfurization equipment can significantly reduce SO₂ emissions into the air from coal-fired power plants, CO₂ emissions continue to grow at a rapid pace (see next section).

Despite some progress regarding PM_{2.5} during this period, the Chinese population's exposure levels are still of great concern in the country. It is estimated that in 2020, 99% of China's 1.4 billion inhabitants live in areas where the average annual concentration of fine particles is higher than WHO recommendations²⁰ and 43% live in areas that do not meet Chinese national standards. And the progress made could be fragile: Smart Air, a social enterprise based in Asia, points to an increase in PM_{2.5} concentration in 8 of the 15 cities monitored between 2018 and 2019²¹. The Chinese "war on pollution" is therefore far from over.

Air pollutants and greenhouse gases: different gases not to be confused

Air pollutants and greenhouse gases are different gases with different consequences, particularly in terms of health implications: the former have direct effects which lead to various pathologies and premature deaths, the latter do not (see Table 1). For example, CO₂ is not directly harmful to humans, whereas nitrogen oxides (NO_x), fine particulates, and ozone (O₃) are particularly dangerous in terms of public health. Air pollution has become the world's 4th leading cause of death at around 6.67 million deaths per year behind hypertension, tobacco, and dietary risks²². In the first half of 2020, 49,000 deaths were attributed to air pollution in Beijing and Shanghai alone²³.

The confusion between these different gases no doubt stems from the fact that the sources of greenhouse gases also emit air pollutants. This is especially the case for

17. Tsinghua University, Health Effects Institute, *Air pollution from coal a major source of health burden in China*, 2016.

18. Y. Xu, "Environmental Policy and Air Pollution in China : Governance and Strategy", Routledge Studies in Environmental Policy, 2021.

19. Global Energy Monitor, "China Dominates 2020 Coal Plant Development", février 2021.

20. Air Quality Life Index, "China Fact Sheet", 2020.

21. "Did China air quality improve in 2019?", Smart Air Filters, 2020.

22. Health Effects Institute, *State of Global Air 2020. Special Report*, Health Effects Institute, 2020.

23. Reuters Staff, "Smog causes an estimated 49,000 deaths in Beijing, Shanghai in 2020 - tracker", Reuters, 2020.

the combustion of fossil fuels which is responsible for more than half of the world's greenhouse gas emissions²⁴ as well as many other air pollutants. However, all these pollutants are different, not only in terms of their consequences (local or global) and how long they remain in the atmosphere²⁵, but also in terms of the technologies that can be used to limit them. There are a large number of so-called pollution control technologies which differ according to the type of pollutant targeted. For example, some technologies aim to improve the efficiency of the combustion process, thereby reducing the emissions generated per kWh produced (for example, burners that emit low quantities of NO_x to increase combustion efficiency). Others are designed to treat flue gas by capturing substances before they are emitted into the air and storing them (e.g., enhanced mercury particle control filters flue gas to capture mercury particles generated during coal combustion). Since the 1970s, a number of SO₂ and NO_x control technologies have been developed in the United States, Europe, and Japan.

TABLE 1 • SOME AIR POLLUTANTS AND GREENHOUSE GASES

Pollutants responsible for...	
Air pollution	Climate change
Particulate Matter PM	Accounted in Kyoto Protocol: Carbon Dioxide CO ₂ Methane CH ₄ Nitrous Oxide N ₂ O Hydrofluorocarbons (HFC) Perfluorocarbons (PFC) Sulfur Hexafluoride (SF ₆)
Nitrogen Oxides NO _x	
Ozone O ₃	
Benzene C ₆ H ₆	
Carbon Monoxide CO	
Hydrocarbons COV	
Metals	
Pesticides	Others: Ozone O ₃ Particulates and aerosols.
...	

Carbon Capture and Sequestration (CCS) technology only aims to capture the CO₂ emitted during the combustion of fossil fuels. Currently, this technology is not widely used, even in new thermal power plants, because of its high cost²⁶.

Water Pollution in China

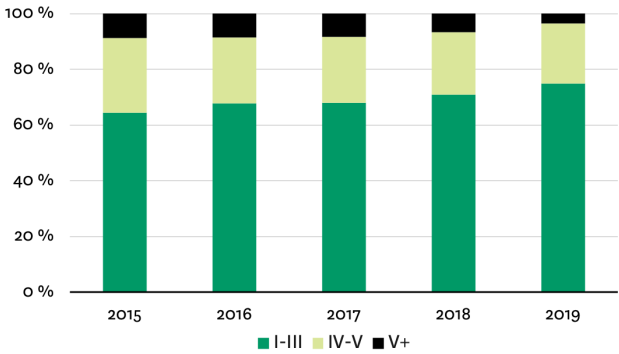
In terms of premature deaths, air pollution problems have become more important than water pollution problems in China²⁷. However, the quality and quantity of water remain a concern due to rapid urbanization and the

importance of the country's industrial sector. The main sources of pollution are urban and industrial wastewater, but also the massive use of fertilizers and pesticides by the Chinese agricultural sector²⁸.

To oversee water quality, several hundred stations monitor 318 rivers and 26 lakes in the country's 9 river basins. All stations are monitored on a monthly basis under the authority of the MEE. Samples are analyzed for eleven parameters (water temperature, pH, etc.), several of which are used to assess the degree of pollution²⁹. Each sample is classified into one of six following water quality categories according to its concentration of different pollutants:

- Category I: water usable as a source of drinking water (i.e., usable without treatment) and, at the national level, for nature reserves;
- Categories II and III: Water that may be used as a Class A or B source of water for centralized drinking water supply, rare fish species sanctuaries, and fish and shellfish spawning grounds;
- Category IV: water that can be used as a general industrial and recreational water source without direct human contact with the water;
- Category V: water suitable only for agriculture and general landscaping;
- Category V+: water unfit for any purpose.

FIGURE 3 • SURFACE WATER CLASSIFICATION³⁰



Note: Depending on year, grades I,II, and III may not be distinguished; classes IV and V may or may not be distinguished.

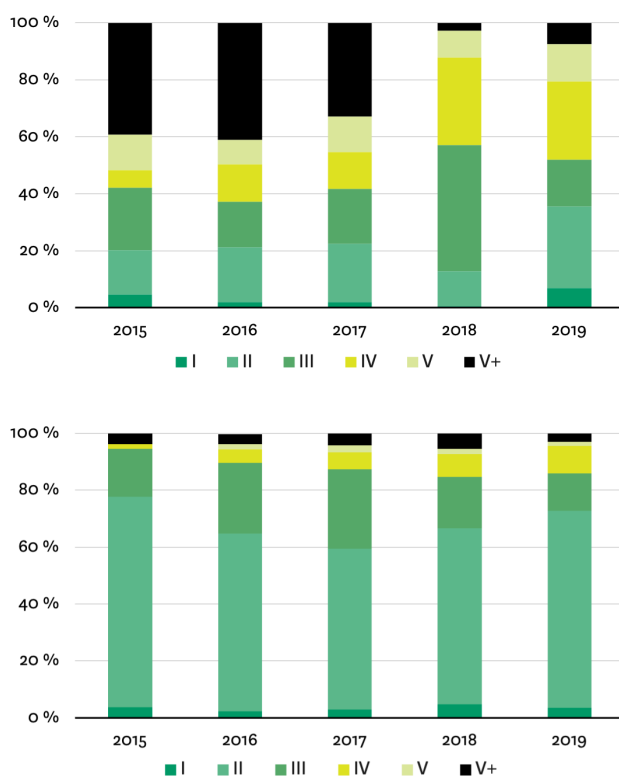
24. United-States EPA, *Global Greenhouse Gas Emission Data*.
25. Aerosols and particles remain suspended in the atmosphere for a short time, about one day to one week, while GHGs remain there for a longer period. CO₂, for example, requires a period of hundreds to thousands of years for it to be absorbed from the air by other reservoirs: ocean, biomass, soil, etc.
26. Climate Change, "Capture et séquestration du carbone. Une solution qui peine à se concrétiser" Observatoire mondial de l'action climatique non-étatique, 2018.
27. The Institute for Health Metrics and Evaluation (IHME), China data, University of Washington.

28. B. Sun et al., "Agricultural Non-Point Source Pollution in China: Causes and Mitigation Measures", *Ambio*, 41, 2012.
29. The main pollutant responsible for the poor ranking of a water sample is NH₃-N (due to fertilizer runoff, but also to wastewater treatment plant discharges and septic tank overflow); added to this are biochemical oxygen demand (BOD) and chemical oxygen demand (COD)-both of which are more closely related to discharges from human and animal wastes and some industrial activities.
30. Sources : Ministry of Environmental Protection, 2015 and 2016. *Report on the State of the Environment in China*, The People's Republic of China. Ministry of Ecology and Environment, 2017, 2018 and 2019. *Report on the State of the Ecology and Environment in China*, The People's Republic of China.

Each year, the MEE publishes data on the quality of surface water, lakes, and groundwater. Figure 3 shows the results for all the samples taken for the 9 basins in the country. Since 2015, there has been a slight and steady decline in the percentage of withdrawals of grade IV and above.

The situation is in fact very different depending on the basin. Figure 4 shows two very different examples. Withdrawals below grade IV in the Pearl River basin are relatively small, although in the last two years the percentage has increased slightly. In contrast, water quality in the Haihe River is worse, with about half of the samples below grade IV.

FIGURE 4 • SURFACE WATER CLASSIFICATION FOR TWO BASSINS: HAIHE RIVER (ABOVE) AND PEARL RIVER (BELOW)³¹



Note: Between 2017 and 2018, the percentage of samples classified as V+ greatly decreased while the percentage of IV greatly increased. The report offers no explanation for these significant changes.

The Asia Society Policy Institute (2020, 2021)³² uses MEE data to construct a surface water quality indicator for the freshwater system that includes the Yangtze, Yellow, Pearl, Songhua, Huai, Hai, Liao, and Zhejiang-Fujian River basins. Their analysis tracks the evolution of this indicator since the third quarter of 2014. A slight improvement is measurable since that date, but the results re-

main quite fragile; for example, there is a marked decline in quality in the third quarter of 2019, especially for the Huang River.

Soil pollution in China

Because of the famine caused by Mao's Great Leap Forward (1958-1962), which killed tens of millions of people, food security has been a priority for the Chinese authorities since the 1950s. This goal has led to the continuous increase in the area of agricultural land, which has sometimes resulted in the cultivation of land near mines or industrial facilities.

Since the late 2000s, a decade after the victory of the communists, several health scandals have affected the country, including the discovery of dangerous levels of heavy metals in some food products, causing widespread public outcry^{33,34}. In 2013, for instance, Guangzhou food safety officials found cadmium in several rice samples. The Ministry of Environmental Protection estimates that heavy metal contamination affects 12 million tons of grain each year (about 2% of China's grain production), which is enough to feed 24 million people annually³⁵.

Started in 2005, but only published in 2014, a national soil pollution survey has been jointly conducted by the Ministry of Environmental Protection and the Ministry of Land and Resources of China. Previously, there were no official statistics on the state of its soil. The findings are particularly concerning: 16% of surveyed soils were classified as polluted beyond acceptable standards, and heavy metal contamination reached 19.4% of total arable land³⁶. The geographical distribution of the results was not published, but the findings revealed that pollution in southern China is more severe than in the north. The Yangtze River and Pearl River deltas, as well as northeastern China, are polluted due to the widespread presence of heavy industry. Levels of heavy metal concentration are particularly high in the southwest and south-central regions, which are the main regions for metal mining and smelting. In 2014, Wang Shiyuan, China's Vice-Minister of Land and Resources, announced that about 3.33 million hectares of farmland were too polluted to be cultivated, an area slightly larger than Belgium. The authorities have banned all agricultural production on these lands to prevent toxic metals from entering the food chain.

As with air and water, the quality of 1550 billion mu of permanent agricultural land was assessed nationwide by

33. In 2011, millions of hectares of farmland and 12 million tons of Chinese rice were contaminated with cadmium, a carcinogenic heavy metal.

34. In 2016, China recorded more than 500,000 violations of food standards ranging from rice contaminated with heavy metals to lotions for infants containing lethal levels of industrial chemicals. Reuters, 2016.

35. Goldman Sachs Global Investment Research, "China's environment : big issues, accelerating effort, ample opportunities", July 2015.

36. China Council for International Cooperation on Environment and Development (CCICED), "Special policy study on soil pollution management", 2016.

31. Sources : Ministry of Environmental Protection, op. cit.

32. Asia Society Policy Institute, *China Dashboard Winter 2020*.

the MEE according to 10 categories³⁷ with category 1 being the best and category 10 the worst. At the end of 2019, the average quality was assessed at 4.76: 31.24% of the total was classified in categories I to III, 46.81% in categories IV to VI and 21.95%³⁸. This shows a slight improvement in the quality of arable land: the average quality was 5.09 in 2017 with 27.4% for categories I to III, 45% for IV-VI and 27.6% of poor-quality land.

What results have been achieved since China went to war on pollution?

It is not easy to draw a clear conclusion about the state of the environment in China as results for air, water, and soil quality vary across regions.

Environmental quality is improving in some areas (air quality in Beijing) and deteriorating in others (water quality of the Haihe River) but pollution levels, especially air pollution, remain far above WHO standards, making pollution a major public health issue in China. The war on pollution thus seems far from won. Yet, in September 2019, Prime Minister Li Keqiang reaffirmed that economic development must remain the country's primary goal, and the CCP head of the Ministry of Ecology and the Environment admitted that while environmental degradation remains a concern in China, the urgency of stimulating local economic growth only makes it more difficult to maintain environmental protection efforts³⁹.

37. Mu is a unit of area measurement used in China corresponding to about 1/15 of a hectare, or about 666.67 m².

38. *Report on the State of the Ecology and the Environment in China*, 2019, Ministry of Ecology and Environment, the People's Republic of China.

39. Time, "The Environmental Challenges of China's Recovery After Covid-19", consulté le June 2 2021.



Federico Cugurullo • Assistant Professor
in Smart and Sustainable Urbanism, Trinity
College Dublin

“One AI to rule them all”: The Unification of Chinese Urban Governance Under Artificial Intelligence

The premise: artificial intelligence and the unification of urban governance

We live in a time when the development of cities cannot be understood anymore as the sum of different and disconnected processes carried out by diverse intelligences. Urban development has always been an extremely complex and multifaceted activity comprising, for example, the creation of new urban spaces and the maintenance of the existing built environment, the preservation of the natural environment, the attraction and investment of capital and the fulfilment of citizens' social needs. Because of the sheer diversity of spaces, activities and services that underpin urban development, traditionally its governance has been operated by different actors in charge of different urban domains. This of course does not mean that urban actors have performed their job in silos completely disconnected from central governments and from other urban actors. Yet there is a fundamental difference, for instance, between an Environment Bureau in charge of protecting local ecosystems and a Public Safety Department meant to ensure the protection of citizens. The difference lies in the fact that, in this example, different urban services are delivered by different human actors who have an impact on different urban spaces. In this paper, I argue that this condition is being radically altered by artificial intelligence (AI). In the following sections I discuss the case of China's urbanization to illustrate how, what was once a multiform urban governance characterized by a plethora of different actors, offices and spaces, is now converging towards a single artificial intelligence and a single cyberspace. We begin our exploration with China's environmental policy and ecological ambitions, to see how the environmental governance of Chinese cities is going beyond physical spaces and human actors.

The case: the platformization of China's urbanization

In 2020, the Chinese government announced an ambitious environmental programme aiming to peak carbon emissions by 2030 and to reach carbon neutrality by 2060¹. This broad national programme reflects a number of environmental initiatives that are taking place in cities which are both the engine of China's economic growth and the cause of its environmental problems². For example, recent studies show that while Chinese cities are responsible for 75% of the national GDP, they are also responsible for more than 70% of the whole country's carbon emissions, and for significant loss of natural habitat. It is in this complex urban context, in which economic priorities clash against environmental dilemmas, that AI is emerging in China as an instrument to manage the country's rapid urban expansion and to decarbonize its cities. Innovation in AI was pushed forward in China by the State Council (China's chief administrative authority) in 2017 with the publication of the New Generation of Artificial Intelligence Development Plan, and it is now culminating in the creation of so-called city brains³. A city brain is a type of urban artificial intelligence meaning an AI that is capable of acting autonomously in urban environments, on the basis of information acquired through sensory experience. More specifically, city brains are urban AIs located in digital platforms through which they manage large portions of urban governance, ranging from transport to safety and from environmental preservation to urban planning.

Although similar urban AIs exist in other parts of the world, city brains are a Chinese invention. The first city brain was developed in 2016 by the Chinese tech giant Alibaba which installed it and tested it in the city of Hangzhou in the Zhejiang province. Alibaba's city brain is emblematically called City Brain and its functions and applications exemplify the characteristics of this urban AI and its impact on urban governance. City Brain's original function pertained to the management of Hangzhou's traffic. This urban AI is capable of sensing the surrounding environment by means of hundreds of CCTV cameras distributed in the city⁴. These cameras act as the eyes of the city brain: they observe what is happening in the city, by

1. S. Mallapaty, "How China could be carbon neutral by mid-century", *Nature*, 586, 2020.
2. K. Tang, Y. Liu, D. Zhou, Y. Qiu, "Urban carbon emission intensity under emission trading system in a developing economy: evidence from 273 Chinese cities", *Environmental Science and Pollution Research*, 28(5), 2021 ; Y. Wang, X. Fang, S. Yin, & W. Chen, "Low-carbon development quality of cities in China: Evaluation and obstacle analysis", *Sustainable Cities and Society*, 64, 2021 ; Y. Tu, B. Chen, L. Yu, Q. Xin, P. Gong, & B. Xu, "How does urban expansion interact with cropland loss? A comparison of 14 Chinese cities from 1980 to 2015", *Landscape Ecology*, 36(1), 2021.
3. F. Wu, C. Lu, M. Zhu, H. Chen, J. Zhu, K. Yu, & Y. Pan, "Towards a new generation of artificial intelligence in China", *Nature Machine Intelligence*, 2020.
4. F. Cugurullo, "Urban artificial intelligence: From automation to autonomy in the smart city". *Front. Sustain. Cities*, 2(38) 2020.

producing data in real-time. This real-time data is combined, in the city brain's digital platform, with big data in the shape of, for example, urban maps and weather forecasts. Once blended, this vast pool of data allows City Brain to develop a situational awareness regarding the traffic conditions of Hangzhou⁵, for policy makers to intervene in the present and change the future mobility of the city. In practice, City Brain can predict when and where traffic congestion is likely to occur, and it autonomously optimizes the city's traffic lights to avoid the formation of traffic jams⁶.

The role of City Brain in the governance of urban transport and mobility resonates with China's environmental ambitions. According to Alibaba, the application of this urban AI has already decreased traffic congestion by 15% and reduced travel time by 8%⁷. Provided that car ownership does not increase substantially, these results can correlate positively with reductions in carbon emissions, since the new mobility patterns established by City Brain effectively means that, in a city like Hangzhou, cars get stuck in traffic for less time and are able to complete their journey faster. This in turn means that, as cars are in motion for less time, overall they generate less carbon emissions which is exactly what Chinese policy makers need to achieve as soon as possible, in order to decarbonize the whole country by 2060.

This is only the first part of the story. As mentioned earlier, city brains reside in digital platforms which, as the literature on platform urbanism shows, are being increasingly used all around the world to manage urban services⁸. Digital platforms have a peculiar architecture that makes them highly versatile and compatible with numerous types of data and services⁹. Essentially a digital platform has a modular structure allowing for easy assembly and flexible arrangement, beyond the original purpose and capabilities. In the case of City Brain, this means that the digital platform where this urban AI operates can be easily expanded by Alibaba to incorporate functions that go beyond the management of traffic. Once again there is a connection with China's environmental programme, since part of the evolution of City Brain has been perfectly in line with the country's aim of decreasing carbon emissions and preserving the natural environment. For example, a new component of City Brain's digital platform is called Environment Brain which combines a geolocation system with environmental data to anticipate how much waste will be produced, predict the capacity of

photovoltaics and foresee the carbon footprints of private companies¹⁰. The logic is the same as the one that was originally applied in Hangzhou to optimize traffic. The city brain collects data and employs it to develop predictions about what is likely to happen in a given urban system, for that system to be optimized in advance. The technology is also similar. Sensors are employed to develop a situational awareness of the city, as it is in the present, and then the AI predicts its future. What differs is the aspect of the city that is taken into account in the analysis of the present and the anticipation of urban futures. Originally, the urban aspect that City Brain was focusing on was traffic. Later, the AI's focus was extended to environmental aspects such as waste, clean energy and carbon footprint, by means of the flexible architecture of the digital platform that allows Alibaba to plug in new analytical and predictive features related to more and more urban domains. But where does the expansion of City Brain's digital platform end? And where does the agency of this urban AI stop?

The answer to both questions is: it does not stop. The modular structure of a digital platform is purposely designed to grow ad infinitum. New components, features and capabilities can, from a technical perspective, always be added, provided of course that they are compatible with the original logic and technology. On these terms, Alibaba can keep expanding City Brain, provided that its new functions relate to the accumulation of data about present cities and the algorithmic predictions of urban futures. Moreover, it is important to remember that, although a city brain has physical components such as computers and sensors, its core essence is digital and located in an infinite cyberspace where endless growth is theoretically possible. City Brain's digital platform can thus keep growing without any immediate physical limit and so its agency since, for every new feature and component that is plugged in, this urban AI extends its agency to another aspect of the city.

This is exactly what has been happening with Alibaba's City Brain. This city brain originally built to manage urban traffic, was then expanded to manage domains of environmental governance, such as waste and energy, and it has now been further expanded to control aspects of urban governance, that include healthcare, supply chains and finance. Furthermore, the same AI that was once operational only in Hangzhou, can now be found in the governance of over twenty cities in and beyond China, including Kuala Lumpur in Malaysia. The growth of this city brain and that of its agency in urban governance do not stop.

The repercussion: one AI to rule them all

The platformization of China's urbanization has just

5. F. Caprotti, D. Liu "Platform urbanism and the Chinese smart city: the co-production and territorialisation of Hangzhou City Brain". *GeoJournal*, 2020.

6. J. Zhang, X. Hua, J. Huang, X. Shen, J. Chen, Q. Zhou & Y. Zhao, "City brain: practice of large-scale artificial intelligence in the real world", *IET Smart Cities*, 2020.

7. Alibaba, "City Brain now in 23 cities in Asia", 2020.

8. S. Barns, "Platform urbanism: negotiating platform ecosystems in connected cities", Springer, 2019.

9. A. Lee, A. Mackenzie, G. Smith, P. Box, "Mapping platform urbanism: Charting the nuance of the platform pivot", *Urban Planning*, 2020.

10. Alibaba, "Environment Brain", 2021.

begun. What this terminology seeks to capture is the increasing employment of digital platforms in the governance of the many aspects that underpin the development and life of cities, from their waste to their mobility and from their carbon emissions to their finance, health and security. The list of these urban aspects is long and it is being quickly covered by the agency of city brains which are now emerging as leading actors in the governance of Chinese cities. This trend can be observed by looking at the specific case of Alibaba's City Brain, discussed above, but it is also observable in three broader trends that characterize contemporary China. The first one is the diffusion of digital platforms which are being increasingly used in the Chinese society to manage a wide and diverse array of data¹¹. The second one is the practice of smart urbanism almost all over urban China, which with its emphasis on sensors and data to optimize urban governance, represents the urbanistic antecedent of platform urbanism¹². The third one is the push of the Chinese government for research and development in the field of AI, with the aim of establishing China as an AI superpower¹³.

From an environmental perspective, AI-enabled urban platforms are a double-edged sword around which there is a growing academic debate¹⁴. On the one hand, some scholars argue that environmental monitoring and waste management (which are among city brains' capabilities) can be enhanced by AI¹⁵. Similarly, with road traffic accounting for a substantial portion of global carbon emissions and for approximately 10% of China's CO₂ emissions, its autonomous management and optimization via a technology such as City Brain cannot fully decarbonize cities, but it can indeed contribute to that goal¹⁶. On the other hand, it is unlikely that AI will fix urban issues of biodiversity loss, simply because in China, for instance, these problems are caused by the expansion of urban spaces that end up consuming and replacing natural spaces. AI is not a magic wand capable of recreating nature out of thin air. In addition, it is crucial to remember that AI consumes nature in the first place. Producing AI technologies requires mining critical minerals and metals in and outside China¹⁷. Most importantly, as this article has

discussed, environmental features are just one module of digital platforms' modular structure. Within these digital systems, no module operates in isolation. Interconnectivity is key to their mechanics and, with the platformization of the urbanization of China set to continue apace, there are three broader interconnected repercussions that we need to consider.

First, there is the issue of data blending. Chinese city brains harvest large amounts of data from a variety of sources. Images of people and places captured by CCTV cameras. Levels of energy production and consumption calculated by smart meters. Patterns of urban mobility understood via tracking systems. Carbon emissions measured by smart sensors. But also private information that was recorded in the past in government databases, as well as real-time and potentially sensitive information that almost every Chinese citizen is now producing by means of social media and mobile apps. From different corners of China and from different parts of its cities and society, all this data eventually ends up in the same digital platform. Within this platform, the origin of each piece of data and the original purpose for which it was produced and collected, do not matter anymore. Every bit of data gets blended and can be repurposed for aims that go well beyond the initial urban domain from which the information was coming from. This of course is an issue that is not exclusively Chinese. Quite the opposite, in fact. Under the influence of powerful digital companies based in the West, such as Google and Facebook, societies from all over the world are seeing their personal data be repurposed to foster targeted advertising, predictive policing and, in a word, surveillance¹⁸.

Second, there is the issue of the understandability of urban AI and of the digital system in which it operates. The platformization of China's urbanization means, in practice, that a lot of data and services are moving to the digital realm. Almost paradoxically, cyberspace is nowadays immediately accessible from almost every urban area, including our domestic spaces, through a simple smartphone. Yet, cyberspaces are far away from physical spaces. They are located in different dimensions and their very fabric presents strong differences. These differences, together with the fact that a digital platform, such as the one where City Brain resides, is managed by a non-biological intelligence, make digital spaces and artificial intelligences very hard to understand by the majority of the population. This is an issue that has been perfectly captured in the literature on so-called XAI which stands for Explainable Artificial Intelligence¹⁹. In essence, what this strand of literature shows is that AI is an arcane and esoteric technology. The complexity of algorithms, how

11. F. Caprotti, D. Liu, "Emerging platform urbanism in China: Reconfigurations of data, citizenship and materialities", *Technological Forecasting and Social Change*, 2020.
12. A. Karvonen, F. Cugurullo, F. Caprotti (Eds.), *Inside smart cities: Place, politics and urban innovation*, Routledge, 2018.
13. H. Roberts, J. Cows, J. Morley, M. Taddeo, V. Wang, L. Floridi, "The Chinese approach to artificial intelligence: an analysis of policy, ethics, and regulation", *AI & SOCIETY*, 2021 ; K. F. Lee, *AI superpowers: China, Silicon Valley, and the new world order*, Houghton Mifflin Harcourt, 2018.
14. T. Yigitcanlar, F. Cugurullo, "The sustainability of artificial intelligence: An urbanistic viewpoint from the lens of smart and sustainable cities", *Sustainability*, 12(20), 2020.
15. C. Scoville, M. Chapman, R. Amironesei, C. Boettiger, "Algorithmic conservation in a changing climate. *Current Opinion in Environmental Sustainability*", 51, 2021.
16. L. Zhang, R. Long, H. Chen, J. Geng, "A review of China's road traffic carbon emissions", *Journal of Cleaner Production*, 207, 2019.
17. L. Zhou, H. Fan, T. Ulrich, "Editorial for Special Issue 'Critical Metals in Hydrothermal Ores: Resources, Recovery, and Challenges'", *Minerals*, 2021.

18. S. Zuboff, *The age of surveillance capitalism: The fight for a human future at the new frontier of power*, Profile Books, 2019.
19. A. B. Arrieta et al., "Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI", *Information Fusion*, 58, 2020.

they are written and how they actually function, is such that those who do not have a background in computer science would struggle to understand their operation. Similarly, the modular structure of digital platforms and the seas of data that they ingest can be so complex to the point of being fully comprehensible only to data analysts. This is an issue because AIs and digital platforms are now being used to govern cities, thereby impacting real spaces that are part of our everyday life and, above all, our lives. There is thus a problematic asymmetry of knowledge in the condition of citizens who do not comprehend the AI that is shaping their life, while the AI itself, thanks to the immense blended datasets at its disposal, knows everything about them.

Third, there is the issue of centralization, intended as the concentration of power into a centralized AI. A city brain is a centralized AI in the sense that the power to know multiple aspects of cities, their lives and the life of citizens, as well as the power to actively govern cities and influence their development lies within a single AI, as opposed to it being distributed among various human and artificial intelligences. Of course, human agents continue to play an important role in the governance of cities. In

China, for example, City Brain itself could not function without humans. It needs Alibaba's computer scientists to build its digital platform and to write the algorithms that allow it to act. It also needs Alibaba's data analysts to feed it with the data that is eventually used to develop predictions. And, last but not least, it needs human labor to build all the physical infrastructure, from computers to smart grids and from sophisticated sensors to simple cables, without which its digital realm could not exist. However, as the literature on urban artificial intelligence shows, cities are experiencing a passage towards autonomy. This is happening in and beyond China²⁰. Urban technologies and services that were traditionally operated by human agents are increasingly functioning in an autonomous manner. We are entering the age of the autonomous city: a city controlled by AI, in which more and more humans are left out of the loop. When the AI in charge is a city brain, the majority of power gets concentrated into one AI ruling not just over one city, but over many cities. Whether such omniscient, and potentially omnipotent, AI will turn into an enlightened absolutist or into a despotic tyrant is a question that needs to be urgently asked and answered before it is too late.

20. F. Cugurullo, *Frankenstein Urbanism: Eco, Smart and Autonomous Cities, Artificial Intelligence and the End of the City*, Routledge, 2021.



Stéphanie Monjon • Scientific Director of this issue, Professor and Researcher, Laboratoire d'Économie de Dauphine, Université Paris Dauphine - PSL University

Élodie René • PhD student at University of Northampton

The New Tools of Environmental Governance in China: Top Down Control and Environmental Credit

“... to allow trustworthy people to come and go wherever they like, while making it hard for discredited people to take a single step”. Conseil d'Etat, 2014.

In the early 2010s, extreme environmental degradation in China and its tragic health effects have taken centre stage. Several events have no longer permitted the environmental crisis in the country to be downplayed¹. All the environmental spheres which were already degraded in the Maoist era are being seriously affected, whether it is water, air, or soil, all warning lights are flashing red. While the water pollution issues which had already been present for years remained less visible, the thick smog affecting many areas of the country revealed the seriousness of the situation. The extent of soil pollution and its effects on food production was exposed when a 2014 government report concluded that 20% of China's arable land was seriously polluted by heavy metals, leading public authorities to prohibit farmers from cultivating 3.33 million hectares (conversion in acres : 8.23 million acres) of agricultural land— a surface area which is a little more than the size of Belgium². Even though it is difficult to assess the exact consequences in terms of public health, everyone understands that a significant part of the country's population is exposed to a cocktail of pollutants in the air,

water, and food on a daily basis and on an unprecedented scale. There is growing concern among citizens and the expatriate community³ and the lack of public action now seems to be generating much more discussion. There is growing pressure for publishing more environmental data and for taking action against pollution. Social concern is turning into indignation as the frequent falsification of environmental data, health scandals, and repeated violations of environmental protection laws by public companies with the complicity of local governments are exposed⁴. Faced with protest movements which sometimes turn violent, public authorities have begun to fear the political consequences of the environmental crisis.

This crisis of confidence among the population towards the State is not isolated to the field of environmental protection. The application of national regulations by local governments and state-owned companies has long been a major issue for central authorities. Since the early 2000s, socio-environmental scandals involving local officials and/or public company executives have increased and contributed to discrediting the Chinese Communist Party (CCP) in the eyes of the population⁵. In response to this moral crisis, and in order to regain citizens' confidence, the Xi Jinping administration, after coming to power in 2012, initiated an ambitious project of modernisation and moralization of Chinese public life in which the social credit system (SCS) is a key element. The first social credit projects in China aimed at modernising the banking sector through the development of financial risk control tools allowing a borrowers' solvency and integrity to be assessed⁶. What is new with the “Social Credit System Construction Plan Outline (2014-2020)” is that this system goes far beyond the banking sector alone and includes all sectors of society. The social credit project in its new form aims at evaluating the “credibility” and “reliability”, in the broadest sense of the terms, of all actors within society and in all sectors (finance, social, environmental, political, etc.)⁷. The system is designed as a disciplinary tool which can reward or punish companies, organisations, managers in public administration, and individuals depending not only on their compliance with national law and regulations, but also on how virtuous or moral their behaviours are⁸.

The SCS aims at developing control mechanisms throughout the whole country that enable central authorities to reward “trustworthy” behaviours (those which

1. In 2011 and 2012, the publication of air pollution measurements made by the United States Embassy in Beijing exposed a significant divergence from the measurements made by the Chinese authorities ; this provoked a public outcry in the country's capital and revealed the insufficiency of the air quality monitoring system as well as an obvious lack of transparency. Since the end of the 2000s, several health scandals have affected the country. In particular, the finding of dangerous levels of heavy metals in certain foods caused a stir among the population: in 2013 for instance, the officials in charge of food safety in Guangzhou found cadmium in several rice samples. In the same period, a wave of cancer affecting villages was discovered. (Y. Li, J. Shapiro, *China Goes Green: Coercive Environmentalism for a Troubled Planet*, Polity Press, 2020). [ndlr] See in the issue the interview of Y. Li and J. Shapiro with C. Pèlegri titled “Green Transition in China: At What Cost?”, page 106.

2. Reuters Staff, “China says over 3 mln hectares of land too polluted to farm”, Reuters, 2013.

3. See for instance: Bloomberg News, “Chinese anger over pollution becomes main cause of social unrest”, March 2013.

4. S. Monjon, S. Poncet, *La transition écologique en Chine : Mirage ou “Virage vert” ?*, Éditions de la rue d'Ulm, 2018.

5. S. Weigelin-Schwiedrzik, “Doing things with numbers: Chinese approaches to the Anthropocene”, *Int. Commun review*, 2018.

6. P. Sel, *Le crédit social chinois*, Politis, 2019.

7. F. Liang, V. Das, N. Kostyuk, M. M. Hussain, “Constructing a data-driven society: China's social credit system as a state surveillance infrastructure”, *Policy & Internet*, 10(4), 2018.

8. P. Sel, op. cit.

abide by legal and moral rules) and to punish “untrustworthy” ones (those which infringe upon legal and moral rules). It is also a way for the central government to strengthen the Party’s legitimacy in the eyes of the population by proposing a practical solution to address a structural issue in China: the weakness of local governments and the circumvention of law by local officials⁹. Even though the western media mainly covered the citizen rating system, the SCS for now remains focused on data from institutional and economic sectors.

The SCS is based on several key mechanisms: the collection and sharing of information among the actors involved, the setting up of a labelling system (are the companies honest, reliable, unreliable, dishonest, etc.) and of red and black lists aiming to identify “trustworthy” or “untrustworthy” actors¹⁰, and the creation of a system of associated penalties aiming to punish “untrustworthy” entities with various disciplinary measures. The system uses both public and private surveillance measures, and therefore involves a wide range of actors (public administrations, courts, banks, public and private companies etc.) at various levels (national, provincial, departmental, municipal)¹¹. The SCS is directly related to the “Internet Plus Government”¹² initiative launched in 2015 by Li Ke-qiang, then Prime Minister, which aimed at expanding the use of digital technology within public institutions in order to facilitate the sharing and exchange of information between the government and citizens as well as between public institutions¹³.

The Corporate Environmental Credit System (CECS) is one of the main subsystems of the SCS aimed at enforcing environmental laws, regulations, and norms by monitoring and sanctioning polluters. Under this system, the central government seeks to address the crisis of public distrust¹⁴ in the regime’s ability to protect people from the effects of pollution¹⁵. The central government’s difficulties in containing environmental degradation, which are partly due to the local obstructions to implementing Beijing’s decisions, are interpreted as proof of the country’s governance deficiencies and may become a threat to the long-term legitimacy and survival of the Chinese State¹⁶. And so, the CCP seems intent on regaining control of the

situation through a series of measures which demonstrate an evolution in environmental protection governance and which are based on greater transparency of environmental data, strong citizen involvement, widespread surveillance of all relevant actors, and the strengthening of top down control.

The first part of this article will outline the difficulties faced by the central government in enforcing environmental rules. The second and the third parts will then turn to the series of measures and actions that the central government has taken to overcome these difficulties with a focus on the corporate environmental credit system.

Limited progress in environmental protection is often attributed to the bad behaviour of various local actors

The saying “Heaven is high and the Emperor is far away” illustrates the difficulties faced by the Chinese emperor to impose his will on remote provinces and is still frequently used in the country today. Despite increasing the number of pollution limitation targets in the five-year plans, the strengthening of the legislative arsenal, and the repeated calls for the creation of an ecological civilisation in official speeches, the central government still faces difficulties in enforcing environmental protection laws. The fragmented and decentralized nature of the Chinese administrative system often leads to a dilution, if not a distortion, of the policy intent of central leaders and is often blamed for the lack of progress. Even though the central government retains political authority on environmental planning, Chinese law delegates the responsibility for its implementation and reporting of all information necessary to the monitoring of the situation to local authorities¹⁷. The difficulties encountered also demonstrate the low priority which is still given to environmental protection in comparison with the priority given to sustained economic growth¹⁸.

Unreliable environmental data

The governance structure and the large number of local authorities pose a serious challenge to the central government in regards to collecting and checking information. In addition to occasional inspection visits, the central government mainly relies on self-reported information to assess the achievement of objectives by local authorities, which leaves room for falsification and misrepresentation.

The lack of resources leads to low-quality local statistics¹⁹. For instance, in Changchun, a city of 7 million

9. Y. J. Chen, C. F. Lin, H. W. Liu, “Rule of trust: The power and perils of china’s social credit megaproject”, *Colum. J. Asian L.*, 32, 1, 2018.

10. Y. J. Chen, C. F. Lin, H. W. Liu, *op. cit.*

11. F. Liang, V. Das, N. Kostyuk, M.M Hussain, *op. cit.*

12. This initiative is also called “e-government” or “digital government”.

13. P. Velghe, “Reading China, The Internet of Things, Surveillance, and Social Management in the PRC”, *China Perspective*, 2019

14. The massive diffusion and the great success of the documentary film “Under the Dome” released in 2015 on Chinese websites (150 million views in 3 days) denounces the links between corruption within Chinese administrations and air pollution issues and can be regarded as an emblem of this crisis of public distrust. The documentary film has been quickly censored by the authorities.

15. For example see: “Airpocalypse’ dirties credibility of Chinese government”, *South China Morning Post*, December 2016.

16. A. Wang, “Chinese State Capitalism and the Environment”, *UCLA School of Law, Public Law Research Paper*, No. 15-52, 2015.

17. L. Zhang, A. P. J. Mol, S. Yang, “Environmental Information Disclosure in China: in the Era of Informatization and Big Data”, *Frontiers of Law in China*, 12, 1, 2017.

18. A. Wang, *op. cit.*

19. K. Lo, “How authoritarian is the environmental governance of China?”, *Envi-*

people located in the country's north-east which covers 350,000 km², energy statistics are only collected for companies over a certain size. Approximately 1,600 companies regularly report statistics on energy consumption to the municipal statistics office; no other data is collected. This parameter only covers about 65% of the city's total energy consumption. K. Lo quotes a public servant from the municipal statistics office: "There is no random sampling inspection. We simply do not have the resources nor the people to do this. In areas where we have no factual information, we use old census data and other information such as historical trends to help us get an estimate [...]. This is why we do not publish energy consumption data in the statistical yearbook. We could not explain the figures if people were to ask"²⁰.

Disagreements between the central government, local authorities, and local Party committees also lead to less effective action from the Environmental Protection Bureaus (EPBs). The data collected by these bureaus is often inaccurate or manipulated as local officials have no incentive to find and report the failures of subordinate authorities²¹. Local officials in charge of assessing the achievement of objectives set by the central government have discretionary power to decide when companies are inspected, or the water quality of a lake is tested; they can also choose to use favourable measurement methods or to limit investment in monitoring equipment. Manipulation and falsification of environmental statistics are often reported and discussed within the government, but also within the media²².

Finally, central environmental monitoring has long been weak. In 2007, the state agency in charge of environmental protection became a ministry, but it remained short on staff and financial resources. The new Ministry of Environmental Protection (MEP) has retained a limited authority to intervene in local affairs. The six regional oversight centres, created in 2006 to establish top down control from central authorities to local authorities in charge of applying the law, were often obstructed by local Party committees and provincial governments, in particular during site inspections^{23,24}. In spite of the increased oversight, falsification of data remains common practice²⁵.

ronmental Science & Policy, 54, 2015.

20. Ibid.

21. G. Kostka, "Command without control: The case of China's environmental target system", *Regulation & Governance*, 10, 2016.

22. "Chinese companies caught falsifying environmental data", *China Dialogue*, 2014.

23. R. Li et al., "Does the Central Environmental Inspection actually work?", *Journal of Environmental Management*, 253, 2020.

24. These supervision centres nevertheless seem to have limited the falsification of data on polluting discharges and to have limited infringements of the law, but at a significant cost. G. Kostka, J. Nahm, "Central-Local Relations: Recentralization and Environmental Governance in China", *The China Quarterly*, 231, 2017.

25. Reuters Staff, "False emissions reporting undermines China's pollution fight", Reuters, 2016; Reuters Staff, "China says pollution inspectors find firms falsifying data", Reuters, 2017.

A fragmented bureaucracy with varied interests

The application of Chinese environmental regulations generally operates under a "double authority" principle: the subnational units of a functional agency not only report to central agencies, but also to the local authorities of the territories in which they operate²⁶. The EPBs take their policy directives from the Ministry of Environmental Protection, but their resources – such as the promotion decisions for their staff – are managed by local governments that often have other agendas which are not easily reconciled with environmental protection²⁷. Local authorities are therefore responsible for the practical aspects of the application of environmental regulations, including the allocation of resources and the deployment of inspectors²⁸.

The local Environmental Protection Bureaus have been traditionally short on human and financial resources while being pressured by local authorities to ignore violations and to reduce fines imposed for environmental pollution. Finally, fees for the emission of pollutants (SO₂, NO_x, COD, etc), which are often too low to significantly reduce pollution, have frequently been used to finance a large portion of local environmental protection budgets, thus providing little incentive to reduce pollution²⁹.

The responsibility of state-owned companies

Leniency among local authorities frequently benefits state-owned companies. The latter are drivers of Chinese state capitalism and are of particular importance to the national economy because they generate a large number of jobs and significantly contribute to achieving assigned growth targets. State companies have a strong presence in heavy industry sectors and are responsible for a large source of Chinese pollution.

Many of these companies have been responsible for a large number of environmental violations and severe pollution incidents. Eaton and Kostka have established a database documenting 2,730 cases of non-compliance by central state companies between 2004 and 2016³⁰. China Dialogue has reported several examples of state companies violating regulations and falsifying the data reported to EPBs³¹. For example, the MPE and National Development and Reform Commission have sanctioned

26. B. Van Rooij et al., "Centralizing trends and pollution law enforcement in China", *The China Quarterly*, 231, 2017.

27. R. Li et al, op. cit.

28. C. Xiang, T. van Gevelt, "Central inspection teams and the enforcement of environmental regulations in China", *Environmental Science and Policy*, 112, 2020.

29. A. Wang, "Explaining Environmental Information Disclosure in China", 44 *Ecology Law Quarterly* 865, 2018.

30. S. Eaton, G. Kostka, "Central Protectionism in China: The 'Central SOE Problem' in Environmental Governance", *The China Quarterly*, 231, 2017.

31. The seriousness of these incidents ranges from procedural violations to major industrial accidents causing serious pollution, injuries and deaths.

19 of them, including the five major Chinese electricity companies – PetroChina and Shenhua, the largest public coal producer – for falsifying their data on desulphurisation. For most of them, this was not their first violation.

Benefiting from a higher administrative position than regulators, state companies are often treated more leniently than other companies in regard to the application of environmental regulations. In Shandong province, state-owned thermal power plants have frequently breached emission rules but the director of the provincial EPB limited prosecution of these facilities because of their perceived political support. Furthermore, Wang reports that the closure of older facilities by the government mostly concerns private companies, whereas when public companies are involved, the closure order can be combined with various advantages such as loans or administrative authorisations for industrial expansion³².

The strengthening of laws and monitoring

The ineffective application of environmental regulations has led to a number of wide-ranging reforms in recent years. The complete revision of the Law on Environmental Protection in 2014 – the first review since 1989 – illustrates the growing importance of environmental issues. After entering into force in 2015, the amended legislation raised certain standards and gave authorities greater ability for the public surveillance of polluters, explicit provisions for dealing with common compliance issues such as illegal discharges, and more power to punish companies and officials responsible for violations, including the falsification of data, by subjecting them to unlimited fines and potential closure.

This legislative development was followed by significant institutional reform in 2018. Until that point, environmental issues had been dealt with by a large number of administrations. The reorganisation of ministries attempted to address this fragmentation of powers. The duties of about fifteen administrations were split between two major ministries. The Ministry of Ecology and Environment (MEE) took charge of environmental protection and the fight against pollution, while the Ministry of Natural Resources (MNR) took charge of the exploitation and management of natural resources. The MEE staff increased from 300 to 500 employees³³. Nevertheless, this new workforce remains small compared to the size of China's territory and the ministry's range of responsibilities such as environmental monitoring, protection, and the enforcement of related laws, nuclear and radiological safety, as well as the organisation of inspections by central authorities³⁴.

32. A. Wang, op. cit., 2015.

33. T. Voita, "Xi Jinping's Institutional Reforms, Environment over Energy?", *Édito Énergie*, Ifri, October 2018.

34. Y. Li, J. Shapiro, op. cit.

Strengthening of top down control

A number of actions have been undertaken to strengthen the top down control of the central government and to overcome the problems stemming from the "double authority" principle³⁵. Such was the case for several key bureaucracies over the years; environmental protection was the more recent target of this recentralisation with the creation of Central Environmental Inspection Teams (CEITs) allowing campaign-style actions to ensure compliance with environmental regulations³⁶.

CEITs report directly to the central committee and are sent to carry out random checks in areas where there is reason to believe that environmental regulations are not applied, notably in areas where there are many complaints or many comments on social media³⁷. Unlike before, inspections now target not only provincial governments, but also provincial Party committees³⁸.

Each CEIT consists of about thirty high-ranking officials reporting directly to the CCP. The experts involved are trained on environmental protection issues and do not have prior relationships between them or with anyone in the inspected area and are given extensive powers. At the end of their initial month-long deployment, the CEIT is called back. In the following months, monitoring teams from the CEIT are sent on site to ensure the resolution of identified violations³⁹.

A new digital environmental governance

Information disclosure and virtual communication between the State and citizens have become ordinary tools of environmental governance⁴⁰. In China, the central government is increasingly using digital technologies to boost interaction with the population and to support the implementation of a digital environmental governance by local authorities. While the government had been caught off guard by the sudden social demand for the disclosure of PM2.5 measures⁴¹, it now seems more actively involved in controlling the debate by occupying online spaces, in particular social media such as Weibo, one of the most important social networks in China often referred to as

35. J. Shapiro, "China's Environmental Challenges", Polity Press, 2016.

36. S. Habich-Sobiegalla, "How Do Central Control Mechanisms Impact Local Water Governance in China?", *Journal of Environmental Management*, 253, 2018.

37. C. Xiang, T. van Gevelt, op. cit.

38. R. Li et al., op. cit.

39. K. Jia, S. Chen, "Could campaign-style enforcement improve environmental performance? Evidence from China's central environmental protection inspection", *Journal of Environmental Management*, 245, 2019.

40. J. Tan, I. Eguavoen, "Digital environmental governance in China: Information disclosure, pollution control, and environmental activism in the Yellow River Delta", *Water Alternatives*, 2017.

41. In 2013, during an episode of serious pollution, the data collected by the sensors of the United States Embassy in Beijing were different from the official data published by China. This situation caused trouble and doubt among the population.

“the Chinese Twitter”⁴².

One of the main goals of this approach is to involve citizens in the surveillance of polluters in order to overcome problems in the reporting of information to the central government. The MEP had already tried to use information disclosure to strengthen the surveillance of local authorities and polluting companies, but the measures remained quite limited⁴³. Several decisions since then have considerably expanded the amount of environmental performance data that companies and local authorities must publish. In April 2014, the amended Law on Environmental Protection introduced a specific chapter on information disclosure and public participation⁴⁴. Article 55 stipulates publication obligations that target the main emitters of pollution. This objective is frequently repeated in official speeches and political texts, and the implementing measures are specified. For instance, in a 2016 ministerial decree, the MEP stressed that “discharging entities must disclose relevant information on emissions and consciously accept public supervision”⁴⁵. Environmental policymakers have laid out rules requiring the “real-time” disclosure of pollution data of more than fifteen thousands major emitters in China. The 2016 Law on Air Pollution Prevention and Control further stipulates that major polluters must install and operate an automated air pollution monitoring system, ensure that it is working effectively, and disclose information on emissions in accordance with the law⁴⁶.

In China, the State and society seem to have accepted the disclosure of information as a regulation tool and as an essential instrument to enforce environmental laws and reduce pollution. Environmental regulatory agencies have been among the more active institutions in regard to the disclosure of information and citizen involvement. Government web pages, mailboxes, and online interviews with agents are now common tools of environmental governance⁴⁷. The microblogs created by the EPBs have been promoted as a tool of environmental information disclosure and citizen cooperation to monitor pollution. The emergence of government-run environmental microblogs, WeChat accounts, reporting platforms, and hotlines have greatly stimulated public enthusiasm for contributing to the supervision and the reporting of polluting companies. This practical access to information has also encouraged the public to express its environmental concerns through online movements such as “#pollution” and “#bluesky”. NGOs also play an active part. The Institute of Public and

Environmental Affairs (IPE), for instance, is dedicated to collecting, compiling, and analysing environmental information disclosed by the government and by companies in order to create an environmental information database. Citizens now have access to hourly data on air and water quality reported by monitoring stations which can be followed on smartphones and online mapping tools. Information disclosure is also perceived as a way to signal to the people a rational, deliberate, and performance-based governance. These evolutions follow the broader purpose of using electronic administration reforms for more transparency, diligence, and participation⁴⁸.

Nevertheless, the data transparency announced and promoted by Beijing should be approached with caution. Microblogs have been presented as a promising attempt to improve environmental governance by promoting transparency and citizen involvement, but also as a new tool to control the online discourse on environmental issues. Ultimately, there is no strong evidence that EPBs microblogs improve the situation. Falsification of data remains a serious problem and the response to the people’s requests for information remains uneven and sometimes nonexistent. Goron and Bolsover analysed the microblogs set up by 172 local environmental authorities in Shandong province and found that these online spaces are impeded by practices aiming at controlling the online discourse on environmental issues⁴⁹. The flooding of platforms with homogeneous content which echo official discourse and State slogans has been documented, as well as the activity of EPB officials registered as ordinary users⁵⁰. The control of environmental discourse therefore seems to have been considerably tightened in recent years. Citizens who have pressed too hard for information have faced retaliation from the State⁵¹.

These measures are part of a broader strategy to restructure Chinese internet governance launched during the first two years of President Xi Jinping’s administration. New institutions have been created to centralise governance in a sphere that has until now been fragmented, while the quest for ideological and technological security has resulted in increased efforts to control online information and prevent possible threats, especially from abroad. Information technologies have facilitated interventions, but also government surveillance and control.

The CECS : measuring environmental performance, incentives, and sanctions

42. I. Hilton, “Guidance and Transgression: The Contest for Narratives of Environment and Pollution in China”, Commentary, International Journal of Communication 11, 2017.

43. B. Van Rooij et al., op. cit.

44. Institute of Public and Environmental Affairs (IPE) and Natural Resources Defense Council (NRDC), “Achievements of One Decade: 2018-2019 Annual Report of Pollution Information Transparency Index (PITI) for 120 Cities”, 2019.

45. A. Wang, op. cit., 2018.

46. IPE, NRDC, op. cit.

47. Ibid.

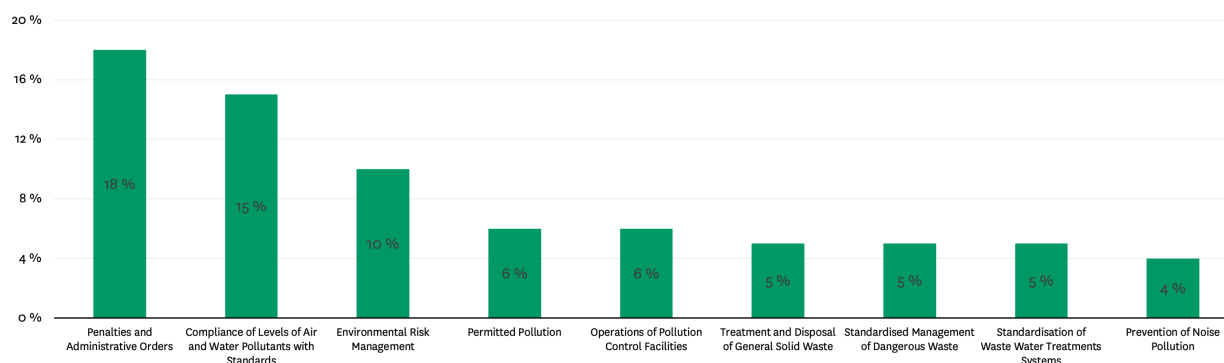
48. L. Zhang, A. P. J. Mol, S. Yang, op. cit.

49. C. Goron, G. Bolsover, “Engagement or control? The impact of the Chinese environmental protection bureaus’ burgeoning online presence in local environmental governance”, Journal of Environmental Planning and Management, 63 (1), 2020.

50. J. Zeng, E. C. Chung, K. E. Fu, “How Social Media Construct “Truth” Around Crisis Events: Weibo’s Rumour Management Strategies After the 2015 Tianjin Blasts”, Policy & Internet, 2017.

51. A. Wang, op. cit., 2018.

FIGURE 1 • 9 FIRST INDICATORS COMPOSING THE CORPORATE ENVIRONMENTAL CREDIT INDEX



The corporate environmental credit system is one of the key tools in the project of modernizing and improving the integrity of Chinese public life. In the central government's official documents, the CESC is presented as "an innovative environmental management system" involving public institutions, companies, and citizens⁵². Carried out under the direction of the Ministry of Environmental Protection (MEP), this system aims at strengthening control on companies emitting pollutants (air, water, soil) in order to penalize those who do not comply with the standards set by the law. The CCP's main concern is to regain the confidence of citizens and to address the current moral crisis, which is particularly related to the numerous environmental scandals. The CECS also aims at improving and formalizing the processes for collecting, analysing, and disclosing environmental information so as to strengthen control of polluters. This framework is also combined with other environmental information governance tools developed by the Chinese authorities in recent years. As a subsystem of the SCS, the CECS is based on the creation of a labelling system (are the companies honest, reliable, unreliable, dishonest, etc.) and of red and black lists associated with reward and sanction mechanisms. These lists are based on the corporate environmental credit rating systems.

In 2014, the MPE published a framework document outlining the general principles of the CECS, which were integrated between 2014 and 2020 into the regulatory systems of the various provinces. This national framework document includes in particular the corporate environmental credit assessment index. This index is associated with a specific scoring method based on 19 indicators (cf annex) aiming at monitoring compliance with environmental regulations and laws in the following areas : 1) pollution prevention, 2) natural ecosystems protection, 3) corporate social and environmental responsibility (CSR)⁵³. This document does not specify the frequency of inspections. The exact means of inspecting industrial sites and the frequency with which scores are reassessed vary from

one province to another.

Each indicator is given a specific weight to calculate the final corporate environmental credit (or score). These indicators notably include information on public complaints and corporate media coverage (falling within the CRS category), which is a way for central authorities to integrate the voice of "the masses" in credit calculation systems. It must be noted, however, that indicators related to public and media participation have a very small weight in the final calculation, 4% and 2% respectively.

Based on this index, companies are divided into four categories. Companies with a green card are included in a "red list" (trustworthy) that gives them access to various advantages (e.g : easier access to credit, reduced frequency of environmental controls, etc.). Companies with a red card are included in a "black list" (untrustworthy) that is made public by local and central authorities. Their environmental scores are then integrated into the general social credit system to which they are attached. "Blacklisted" companies are heavily penalized⁵⁴:

- restrained access to bank credit, public procurement contracts, professional qualification certifications, administrative licences, etc;
- removal of public subsidies and political support ;
- increased frequency of environmental control procedures, etc.

At this time, there is no nationwide corporate environmental credit system, but rather a multitude of provincial and/or municipal systems integrating the general principles enacted by Beijing. Each province must organise itself to develop its own system for collecting and sharing data, for rating and scoring, and for penalizing and rewarding.

This means that each province must develop, under the supervision of central authorities, its own "regulatory forces" by creating cooperation mechanisms between institutions, public agencies, and key companies to improve

52. *Corporate Environmental Credit Evaluation Measures*, Ministry of Ecology and Environment China, 2014.

53. Ibid.

54. Ibid.

communication and data sharing amongst institutions.

The highly developed and industrial province of Zhejiang (the fourth richest province in China⁵⁵), located in the north-east, is often cited as an example in official documents for its implementation of the CECS and, more generally, for the efforts of local authorities on environmental transparency. In this regard, the city of Hangzhou, the economic capital of Zhejiang, has been elected “happiest city in China”⁵⁶ for 12 consecutive years for its economic vitality as the city is notably known not only for being home of the headquarters of the Alibaba group, but also for its lifestyle, with the famous Lake of the West located in the heart of the city. Hangzhou is the third richest city in the Yangtze Delta after Shanghai and Suzhou⁵⁷.

The authorities in Zhejiang seem to demonstrate an exemplary implementation of the CECS, with several dedicated websites (controlled by the local office of environment and ecology) giving public access to regularly updated data on the system. At present, this is not the case in any other province.

In January 2020, the Zhejiang government published a document on the functioning of the CECS in the province, presenting its specific scoring system on a 1,000-point scale. In this document, provincial authorities gave precise details on their rating criteria, integrating most of the indicators proposed by central authorities in the framework document published in 2014 by the MEP. Companies can lose between 10 and 400 points, depending on their respect of environmental laws and regulations. This rating, and therefore system of controlling companies, involves both automated mechanisms for real-time assessment of emissions (monitored by equipment for this purpose) and an on-site assessment by local EPB officials which is random (at least once a year) and whose frequency depends both on the credit of the company and on possible complaints from the public. However, the calculation of environmental scores in the province does not include criteria related to public or media participation, in contrast to the indications – albeit “cosmetic” – recommended at the national level.

In Zhejiang’s system, the environmental credit of the participating entities is divided into five grades, depending on the number of points scored by companies and other environmental assessment organisations :

- Between 1000 and 980 points : grade A (excellent, green card);
- Between 980 and 920 points : grade B (good, blue card);

- Between 920 and 800 points : grade C (medium/fair, yellow card);
- Between 800 and 600 points : grade D (poor, red card);
- Under 600 points : grade E (very poor, black card).

Companies graded A and B are provided rewards and incentives, while companies graded D and E are subject to penalties and disciplinary measures.

While Zhejiang province seems to be a model in terms of implementing the CECS and environmental information governance mechanisms in general, the results obtained by the provincial EPB may be surprising. According to official information, nearly 80% of industrial sites included in the Zhejiang provincial CECS database – 57,312 sites as of 15 April 2021⁵⁸ in the whole province since the system’s creation – were graded A, while less than 5% were graded D or E. Yet this data does not seem consistent with the reports of international and Hong Kong-based NGOs (Wateratrisk⁵⁹, Greenpeace⁶⁰, etc.) warning about alarming levels of soil and water pollution. It seems, however, that in terms of air quality, Zhejiang province is doing better than other industrial Chinese provinces. The main air quality institutes and measurement organisations in China (aqicn.org, IPE) indicate that, in comparison with other Chinese provinces, air pollution levels are relatively moderate in this province. But it should be noted that, unlike the heavily polluted provinces of central and northern China such as Shaanxi province, Zhejiang is not a coal-producing region.

Beyond Zhejiang province, the data collected in other provinces on the official websites of local environmental credit systems are also surprising. Indeed, according to official data in Shenzhen for January 2021, 13.3% of audited companies were on the green list, 90% were blue, 7.1% were yellow, and 1.4% were on the black list⁶¹. In Fuzhou, Fujian Province, 55.47% of companies audited in 2020 were on the green list, 41.4% blue, 1.56% yellow, and 1.56% on the black list⁶².

From one province to another, each system is based on significantly different calculation methods, labelling systems (black list, grade E, etc.), and inspection frequencies, and it is difficult to compare results between provinces. Nevertheless, it is interesting to note that provinces which have set up a CECS and publicly disclose their data have particularly high levels of corporate compliance with environmental laws and regulations. However, given the ex-

55. “Zhejiang among Top 10 Chinese provincial regions with strongest GDP in 2020”, China Daily, February 2021.

56. “Hangzhou listed China’s ‘happiest city’”, govt.chinadaily.com, 2018.

57. “Investing in Hangzhou, Zhejiang Province: China City Spotlight”, China Briefing, 2021.

58. 浙江省企业环境信用评价综合管理系统.

59. F. Hu, “Rivers Flow In Me: Reflections From Zhejiang”, China Water Risk, 2017.

60. “A Monstrous Mess: toxic water pollution in China”, Greenpeace, 2014.

61. 企业环境信用等级评定结果公告-深圳市生态环境局 (sz.gov.cn)

62. 福州市生态环境局关于2020年福州市企业环境信用评价第一批强制评价企业评价结果的公告_信用制度_生态环境局_福州市鼓楼区政府 (gl.gov.cn)

treme levels of pollution in China, this data may not be representative of the environmental impact of companies in their respective locations. This can be interpreted in a number of ways – either the data is falsified or norms and standards concerning pollutants and the protection of natural ecosystems, which are enshrined in laws and regulations, are insufficient to limit pollution and halt the destruction of ecosystems.

Conclusion

China's environmental situation has shown a slight improvement in recent years, but this evolution has taken place at the cost of increased surveillance, control, and penalties⁶³. Decades of neglect and a laissez-faire attitude did not allow a culture of environmental protection to develop. Given the country's authoritarian structure, progress in governance does not necessarily lead to increased responsibility⁶⁴. Far from being solved, the environmental crisis might only be improved through generalised digital and human surveillance and authoritarianism. This is what seems to be happening in China. The CCP's plans for an ecological civilisation gives the central government, including the Ministry of Environment and Ecology, a huge opportunity to expand its surveillance and control system to local authorities and businesses. The CECS allows central authorities to strengthen their influence in the functioning of the regulatory systems of Chinese provinces and large cities. However, the anticipated improvements may take time to materialize. The analysis of the CECS's first results is very surprising, especially since they are unexpectedly positive: a large majority of companies, including those in heavy industry, report excellent results, which fails to explain the severe environmental degradation in the country.

APPENDIX • INDICATORS COMPOSING THE CORPORATE

ENVIRONMENTAL CREDIT INDEX

- Penalties and administrative orders: 18% ;
- Compliance of levels of air and water pollutants with standards: 15% ;
- Environmental risk management: 10% ;
- Operation of pollution control facilities: 6% ;
- Permitted pollution: 6% ;
- Treatment and disposal of general solid waste: 5% ;
- Standardisation of waste water treatment systems: 5% ;
- Standardised management of dangerous waste: 5% ;
- Prevention of noise pollution: 4% ;
- Complaints from the public: 4% ;
- Information disclosure: 4% ;
- "Ecological protection" of industrial sites: 2% ;
- "Ecological protection" in development and construction: 2% ;
- Spill/pollution notification: 2% ;
- Payment of the tax on pollutant emissions: 2% ;
- Compulsory audits to check depollution and cleaning measures: 3% ;
- Media supervision: 2% ;
- Self-monitoring and transparency: 2% ;
- "Ecological protection" in the use of resources: 1%.

63. [ndlr] See in the issue the article of S. Monjon and L. Boudinet titled "*The State of China's Environment: What Has Changed in the Past Few Years?*", page 117.

64. Y. Tan, "*Transparency without Democracy: The Unexpected Effects of China's Environmental Disclosure Policy*", Governance, 2014.



Matthieu Glachant • Professor of Energy and Environmental Economics at MINES ParisTech, PSL University

Simon Touboul • Doctoral student in Economics at the CERNA, Center of Industrial Economics of MINES ParisTech, PSL University

China's Contribution to Low-Carbon Technology Innovation

Keeping global warming to less than two degrees above pre-industrial levels, as stipulated in the Paris Agreement, requires the development of new technologies to more effectively reduce greenhouse gas emissions as well as their deployment in the economies which emit the most carbon. In this respect, China is a country of prime importance. Its technological needs are enormous, with current emissions volume equal to that of the United States, India, and the European Union. The country has just set itself a goal of carbon neutrality by 2060, which implies a drastic reduction in greenhouse gas emissions. It also plays a leading role in certain key sectors for the climate transition: the production of solar photovoltaic equipment, batteries, wind turbines, and the construction and operation of nuclear power plants. But does its contribution to global low-carbon innovation match its needs and potential? Is it among the leaders in the climate innovation race, or does it continue to depend on technologies invented in industrialised countries?

China's low-carbon innovation through research remains limited

Patent data is commonly used to measure technological innovation made through research¹. Each patented invention is classified in a very detailed nomenclature that allows the identification of patents protecting technologies which fight the greenhouse effect. Most countries in the world have data available which allows China to be compared with the rest of the world. However, the unit value's lack of uniformity for patents poses a problem². Indeed, a large majority of patents protect insignificant inventions while a small number concern significant inven-

tions³. Directly using the number of patented inventions to measure innovation can therefore be misleading. The problem is particularly pronounced when it comes to qualifying China's performance⁴. The country's innovators have a stronger tendency to patent, including low-quality inventions, which artificially puts the country at the top of global innovation when measured by the number of patents⁵. There are several solutions to correct this bias. The simplest is to take into account only inventions protected in at least two countries⁶. The cost of patenting in one country is much lower than extending that protection to other countries. An extension therefore signals that the holder considers the prospects for his invention's commercial use to be sufficient.

Figure 1 shows the evolution of Chinese low-carbon innovation from 1985 to 2017 using this indicator. Unfortunately, more recent data is not yet available. It shows that innovation was almost non-existent until the mid-2000s, with the number of Chinese patented inventions not exceeding 1% of the world total. Since then, the country has caught up remarkably well. In 2017, the country accounted for almost 6% of all global low-carbon inventions. This makes it the fifth largest innovator in the world, on par with France. This performance is respectable, but it remains well below that of the three leading countries of Japan, the United States, and Germany, each of which produces between 15 and 25% of global innovation. It is also half that of Korea which, like China, accounted for less than 1% of low-carbon innovation in 1990.

However, as Figure 2 shows, China is very active in two areas: low-carbon information and communication technologies (i.e. technologies that reduce the energy consumption of computer equipment and communication networks) and building technologies. On the other hand, its performance is no better than average in wind and solar photovoltaic energy, areas in which it has a very strong industry.

China is, in fact, not very specialised in low-carbon innovation. It accounts for only about 5% of patented inventions across all technologies, compared with twice that percentage for most industrialised countries. The increase in low-carbon innovation described in Figure 1 is thus due more to a general acceleration of innovation in the country than a reallocation of its efforts to combat climate change. In other words, Chinese innovators appear to be responding more to immediate economic needs

1. OCDE, *Manuel de l'OCDE sur les statistiques des brevets*, 2009.

2. Z. Griliches, "Patent Statistics as Economic Indicators: A Survey". *Journal of Economic Literature*, vol. 28, no. 4, 1990.

3. A. Dechezleprêtre, Y. Ménière, M. Mohnen, "International patent families: from application strategies to statistical indicators", *Scientometrics*. Vol 111, 2017.

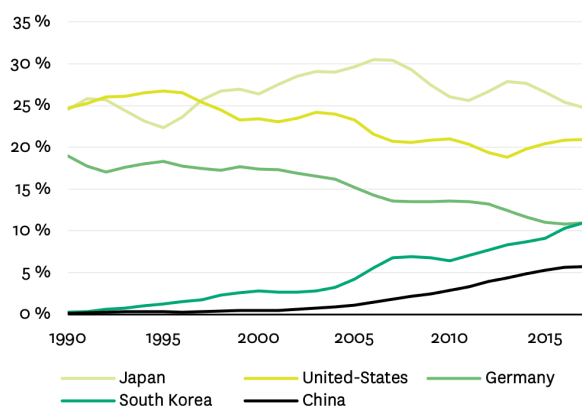
4. P. Boeing, E. Mueller, "Measuring China's patent quality: Development and validation of ISR indices", *China Economic Review*, Elsevier, vol. 57(C), 2019.

5. D. Prud'homme, T. Zhang, "Evaluation of China's Intellectual Property Regime", *Rapport pour la Banque Mondiale*, 2017.

6. In the climate field, this solution is for example used in the recent World Bank report "Invention and Global Diffusion of Technologies for Climate Change Adaptation" which quantifies innovation in climate change adaptation technologies (Dechezleprêtre et al. 2020).

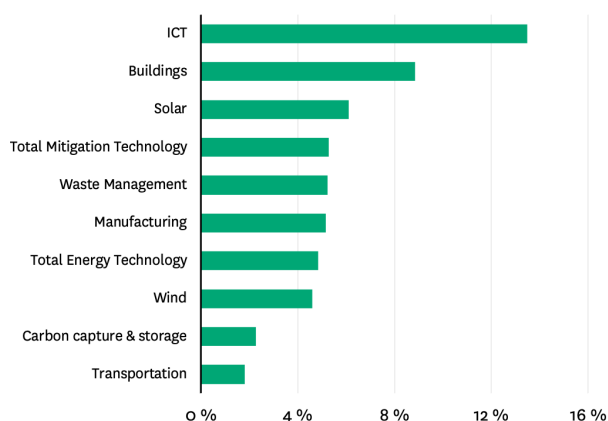
than to be building a low-carbon technology infrastructure as part of a longer-term strategy.

FIGURE 1 • EVOLUTION OF THE SHARE OF GLOBAL LOW-CARBON, HIGH-VALUE INVENTIONS⁷ OF THE FIVE LARGEST INVENTOR COUNTRIES⁸



Is China compensating for this relative weakness by importing foreign inventions? Patent data also provides some answers to this question. A patent provides an exclusive right to exploit the invention commercially for a certain period of time in the country in which it is filed. The fact that a foreign inventor files a patent in China therefore indicates his intention to deploy the protected technology there. The volume of patents filed by foreign inventors in China then indicates the level of international technology transfer to the country.

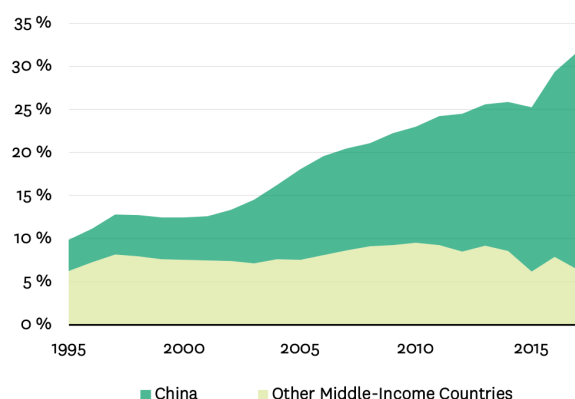
FIGURE 2 • SHARE OF CHINESE INVENTIONS IN GLOBAL INNOVATION IN 2017 BY TECHNOLOGICAL FIELD⁹



According to this indicator, China appears to be highly connected to international technology flows: the country received a quarter of global low-carbon patent exports in

2017. Lagging far behind, the other emerging economies together account for less than 10%. This percentage has stagnated for two decades while the weight of Chinese patent imports has been steadily increasing since 2000 (see Figure 2). Conversely, only 3% of Chinese inventions were exported. This is far from the image of Chinese research providing the world with solutions at the technological cutting edge.

FIGURE 3 • EVOLUTION OF THE SHARE OF GLOBAL INVENTION EXPORTS TO CHINA AND OTHER MIDDLE-INCOME COUNTRIES¹⁰



But China is a major player in the industrialisation of low carbon solutions

“China is the world’s factory,” we often read. The phrase perfectly applies to the wind, battery, and solar photovoltaic sectors. This is of major importance for innovation as it is not only generated in specialised research entities such as public research organisations, corporate R&D departments, or technology start-ups. Knowledge and skills are also generated outside the laboratory through the continuous optimisation of production lines in factories, the knowledge of employees who produce and deploy technologies in the field and, by extension, through the economies of scale that their mass production generates. Arrow¹¹ introduced the terminology of ‘learning by doing’ to designate this process accompanying industrialisation, which can be contrasted with ‘learning by searching’ in laboratories¹². This form of innovation does not give rise to patents, though it is no less rapid or effective than innovation by research. Although individual improvements are modest in scale, their accumulation is capable of producing technological breakthroughs. The Chinese solar photovoltaic industry is a good example of this process.

The performance of photovoltaic technology has in-

7. A high-value invention is defined as an invention patented in at least two patent offices.

8. Source: authors’ calculations from PATSTAT data.

9. Ibid.

10. Ibid.

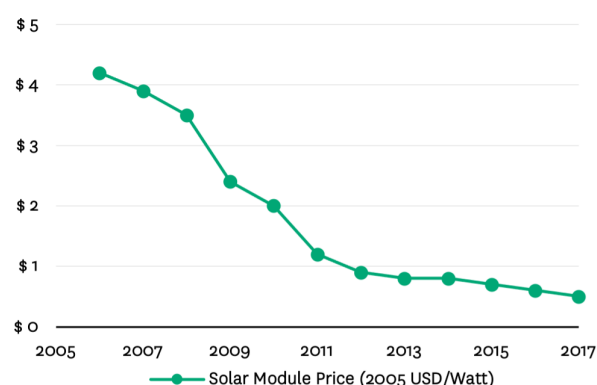
11. J. K. Arrow, “The Economic Implications of Learning-by-Doing”, *The Review of Economic Studies*, Vol. 29, No. 3, 1962.

12. F. Malerba, “Learning by firms and incremental technical change”, *The Economic Journal*, Vol. 102, No. 413, 1992.

creased drastically in a few years. In 2006, the average cost of a photovoltaic panel was over \$4/Watt. In 2017, it had fallen to \$0.5 (Figure 4) – an eight-fold reduction in ten years. Behind this explosive improvement in equipment performance, there has been no major innovation in the research laboratories. Quite the contrary. Following a very active research period in the 2000s to develop alternatives to the established crystalline silicon technology, the beginning of the following decade saw a sharp decline in research innovation. From 2011 to 2014, the number of solar PV inventions worldwide declined by 25%¹³.

FIGURE 4 • PRICE EVOLUTION OF PHOTOVOLTAIC MODULES

2006 - 2017¹⁴



The arrival of Chinese actors in the solar photovoltaic value chain explains this paradoxical evolution of research-led innovation which declines when technological performance soars. These companies do not focus on the most advanced solutions. They adopt standard crystalline silicon technology, buy turnkey module production lines from Western suppliers, build giant module, cell, and silicon ingot factories with high economies of scale, and use their manufacturing experience to operate them. Their ability to cut costs is such that within a few years they have driven out most of their Western competitors who had previously dominated the global market. The bankruptcy in 2012 of the German Q-Cells¹⁵, the world's leading producer a few years earlier, is an example of this. By the end of the decade, the die had been cast. China produces almost three quarters of the solar panels and European, American, and Japanese production has almost disappeared.

Northern companies, however, were the leaders in learning by searching. Their marginalisation has therefore led to a reduction of innovation through research. Patent data confirm this. The reduction in the number of patented inventions is mainly the result of the reduction in the number of innovators in industrialised countries.

13. M. Carvalho, A. Dechezleprêtre, M. Glachant, "Understanding the dynamics of global value chains for solar photovoltaic technologies", World Intellectual Property Organisation Economic Research Working Paper, No. 40, 2017.

14. Source: International Energy Agency.

15. Q-Cells have since been acquired by the South Korean group Hanwha.

Between 2011 and 2014, the number of patent applications in the United States, Japan, Germany, or Korea saw a five-fold decline¹⁶. To use Schumpeter's terminology, the photovoltaic industry has thus experienced "creative destruction" in the 2010s. But it has created a kind of inverse situation, as it has led to the success of traditional technology over more innovative solutions.

The recent evolution of photovoltaic innovation obviously cannot be generalised to other sectors and the victory of learning by doing over learning by searching will only be temporary. The "Solar Power Initiative", launched in February 2021 with the support of the European Commission, is also betting on the relocation of the value chain to Europe through innovation. This example highlights, however, the import effects of learning gained at the industrialisation stage and how China's manufacturing skills can play a crucial role in this process. It also illustrates the close connection between economic globalisation and innovation.

Economic globalisation and low-carbon innovation

China's solar photovoltaic success was enabled by the country's integration into the global economy. Its companies were able to acquire the technologies needed to set up local production of modules, cells, and silicon ingots at low cost because they had access to a competitive international goods market. They supplied their factories with purified silicon imported mainly from Norway and the United States. They then financed learning by doing by exporting most of their modules to Europe, the US, or Japan, which subsidised their purchase¹⁷.

This international division of innovative work, with the more advanced Northern countries generating innovation through research and China contributing to their industrialisation, is fairly classic. The development of international trade has in many sectors led to a geographical fragmentation of the production process by locating different stages of production in countries with the competitive advantages to accommodate them. Are the globalisation of value chains and the subsequent international diffusion of innovation sustainable?

This model is now being called into question due to economic factors as well as by companies who wish to minimise the risk of supply disruptions following what some have experienced during the Covid-19 epidemic. But above all, this is due to a major geopolitical development – the growing rivalry between China and the United States. In this new landscape, there are many signs of a "re-regulation" of international trade. This is particularly

16. M. Carvalho, A. Dechezleprêtre, M. Glachant, op. cit.

17. This situation has changed since. A quarter of the modules produced worldwide are now installed in China.

true in the area of innovation and technology, as illustrated by the restrictions imposed on the Chinese company Huawei by an increasing number of countries.

The question is whether this will be favourable to low-carbon innovation. Will Western countries, led by the United States, and China succeed in making climate issues sacred? Will they be able to cooperate in order to create stringent national emission reduction policies along with shared low-carbon innovations to implement them? The fight against climate change has a distinctive feature that can play a positive role: pollution is global, with everyone's efforts to reduce it benefiting everyone else. We need technical progress, wherever it comes from, to reduce our carbon emissions and, conversely, it is in our interest to provide China with the means to reduce its own.

However, the most recent signals are not all positive. It is true that last autumn China committed itself to reaching

carbon neutrality by 2060 and to reducing its emissions before 2030 and the United States is back in the Paris Agreement. In the short term, however, the 14th Five-Year Plan for 2021-2025 adopted by the Chinese parliament in March envisions an increase in R&D with a priority list of technological fields such as: artificial intelligence, quantum computing, semiconductors, neuroscience, biotechnology, medicine, space and maritime exploration. This is more indicative of a desire to reduce dependence on American technologies than it is a proposal of new low-carbon solutions. The Plan is also unambitious in regard to climate objectives. More uncertain still is the effect of the proposed carbon tax at the EU's borders, which is intended to penalise imports from less virtuous countries in the fight against climate change – and therefore potentially China or the United States. Will this strengthen China's incentive to accelerate decarbonisation or will it trigger trade conflicts that could weaken climate cooperation, without which nothing is possible?



Anaïs Voy-Gillis • Associate Researcher at
CRESAT - Université de Haute-Alsace

Is Chinese Industrial Policy Compatible with its Environmental Ambitions?

On 22 September 2020, Xi Jinping made a commitment to the United Nations General Assembly that China would achieve carbon neutrality by 2060¹, even though the country is the world's largest energy consumer and the largest emitter of carbon dioxide (CO₂). This goal therefore seems particularly ambitious in view of its production structure and organisation, which are mainly centred on heavy and polluting industries, as well as its growth goals.

Although China's environmental commitments begin before 2020, their effects are still somewhat limited. For instance, as early as 2007, President Hu Jintao supported the idea of an ecological civilisation², which he saw as the foundation for a renewed civilisational leadership and would define a new direction of Chinese development.

And so, the environmental issue is also a geostrategic asset on which China has been counting to strengthen its international leadership at a time when Donald Trump's United States was turning away from the matter. Nevertheless, despite China's national five-year plans, its race for growth since the late 1970s has caused irreversible damage to the environment and biodiversity.

The environmental question is mainly addressed through the issue of carbon, whereas in reality it requires a systemic approach. While carbon neutrality is a laudable and necessary goal, it is rarely sufficient on its own. Focusing on carbon can have devastating and disruptive effects on ecosystems. For instance, the construction of dams has serious consequences for entire communities³

1. Statement by H.E. Xi Jinping President of the People's Republic of China At the General Debate of the 75th Session of The United Nations General Assembly, Beijing, 22 septembre 2020
2. C. Goron, "Civilisation écologique et limites politiques du concept chinois de développement durable", Perspectives chinoises, 2018-4 | 2018.
3. The Three Gorges Dam had significant social consequences with the displacement of more than 1.3 million people. The environmental impacts are also significant, with numerous landslides and the disappearance of certain species.

and threatens water resources in areas downstream, with both environmental and economic consequences.

Environmental damages must not only be considered in relation to Chinese territory, but also for peripheral territories where the country may also be tempted to locate some of its most polluting and carbon-intensive activities. One country's carbon neutrality should not be achieved at the expense of another's.

The Chinese central government has progressively strengthened its consideration of environmental concerns by developing a regulatory framework for environmental protection, by adopting a proactive policy in its five-year plans, and by investing in renewable energy. These commitments have been the subject of much criticism, not only regarding their true ambition, but also in how these goals are carried out at the local level, as well as China's capacity to make meaningful changes to its productive model to move towards more environmentally sound and sustainable industries.

China's desire to move towards carbon neutrality raises many questions about this ambition's compatibility with the country's growth goals. While the issue of environmental protection and our system's transformation should be the central concern of all future international agreements, it is hardly mentioned in the Comprehensive Agreement on Investment (CAI) between the European Union and China which was announced this past December 30th^{4,5}. Consequently, questioning the compatibility of China's environmental ambitions with its industrial policy also leads us to broaden the debate to question the Western production model. In fact, by de-industrialising, European nations have transferred part of the environmental responsibility linked to their consumption habits to external parties – including the responsibility related to waste management.

A growth model incompatible with China's environmental ambitions

China's modernisation since the end of the 1970s has been a massive process of industrialisation and urbanisation⁶ with an average annual economic growth of about 9%⁷. The expansion of construction has increased energy-intensive production such as aluminum, steel, and cement. China's intensive growth has also not been wi-

4. European Commission, "EU and China reach agreement in principle on investment", European Commission press release, 30 December 2020.
5. The vice-president of the European Commission Valdis Dombrovskis indicated on Tuesday 4 May the suspension of the ratification process of the agreement concluded in December 2020, due to the tense political climate between the European Union and China.
6. H. Liao, Y. Fan, Y. Wei, "What Induced China's Energy Intensity to Fluctuate: 1997-2006?", Energy Policy, Vol. 35, 23, 2007.
7. According to data made available by the World Bank for the period 1975-2019. Over the period from 1961 to 2019, the average annual growth is just over 8%, which represents a GDP growth of about 122% over the period.

thout consequences for the environment, as it has been dependent on an intensive use of natural resources, very high energy consumption, and long-term pollution of soil, water, and air. Decades of rapid economic growth have reduced nature to the resources it produces and the wealth that can be derived from them⁸.

This massive and destructive exploitation of natural resources has many serious consequences today: diseases⁹, unusable land, artificialization of arable land, etc.

The Chinese production model suffers from inconsistencies that have shaped its development. For instance, the government has supported or supports the development of heavy industries through subsidies or by being a shareholder in public companies, which has led to situations of overproduction in several sectors. In Europe, the most well-known example is certainly steel. Competition is no longer based on quality, but on prices and quantities sold. Each company tries to sell more and at a lower cost, without taking into account the devastating environmental impacts of this type of production and without massive investment in production units to reduce negative externalities. Moreover, this situation has had harmful effects on other industries, particularly European ones who find themselves competing with low-cost, subsidised steel. This prompted the European Commission to take anti-dumping measures in 2016 when the European manufacturing base was experiencing lasting damage from this situation¹⁰.

However, without attempting to minimize the environmental consequences, this development model should be viewed in the context of the global economic pattern that has been in place since the mid-1970s. In 1979, under the leadership of Deng Xiaoping, China moved towards a strategy of opening to Western nations by focusing on developing its industry, and in particular its heavy industries in the eastern provinces of the country¹¹. It has become what is commonly referred to as the “workshop of the world”, though this has not been driven solely by its openness to the rest of the world. This was made possible by the spread of a shared belief in many Western countries that it was necessary to move away from manufacturing activities because they were considered to be of lower value and no longer necessary for the development of these nations. Supply chains were fragmented in the search for greater cost optimisation to the detriment of independence and economic sovereignty considerations.

China has relied on exports of low-cost products to satisfy world demand while developing strategies for acquiring technologies in key areas such as the automobile industry by buying Volvo and Lotus, for instance, and by developing its own national leaders such as the China State Railway Group Company (CR) in the railway sector.

However, this enormous industrial development has relied on massive coal consumption to supply power plants. Coal is cheap in China because the country has abundant¹² and good quality resources, which do not require sophisticated facilities to exploit. Since the first Five-Year Plan (1953) presented it as the main source of primary energy for heavy industries (steel, metallurgy, chemicals), coal has been China’s main energy source. This explains the considerable amount of time needed to move away from dependence on this energy. Coal is also used in the residential sector for heating homes and cooking food.

Its low cost makes it an energy favoured by industries. In 2019, for example, 58% of the country’s primary energy came from coal¹³. Fossil fuels combined represented 86% of primary energy consumption¹⁴ compared with 48.1% in France¹⁵. This distribution is changing, thanks to investment in renewable energies, which now account for around 13% of primary energy consumption (8% for hydroelectricity and 5% for other renewable energies). However, coal-fired power plants continue to be built every year. The closure of coal-fired power plants in Europe and the United States is offset by the opening of new plants in China, despite the country’s carbon neutrality goal Global Energy Monitor, 2020. In 2020, 76% of the 50.3 GW of new coal-fired power generation capacity in the world were Chinese¹⁶.

To address pollution issues and achieve its environmental ambitions, China is investing heavily in renewable energy to meet the 30% target of its energy mix by 2030¹⁷. However, some of the energy produced by solar and wind power is not used and is often not connected to the central electricity grid. As Stéphanie Monjon and Sandra Poncet pointed out, “in the absence of significant technical progress, and without a major change in the way China’s electricity distribution system works, the installation of wind turbines and solar panels, even at a frenzied pace, will not be enough to reduce the demand for coal”.¹⁸ It

8. J. Shapira, *Mao's War Against Nature*, Cambridge University Press, 2001.

9. Cancer is the number one source of illness in China. Several reports highlight the disastrous consequences of polluted water on certain villages where a majority of inhabitants develop cancer.

10. European Commission, *Report from the Commission to the European Parliament and the Council*, 30 April 2020

11. He C., Wang J., “Energy Intensity in Light of China’s Economic Transition”, *Eurasian Geography and Economics*, vol. 48, no. 4, 2007.

12. China has the fourth largest coal reserve in the world. At the end of 2019, China’s proven coal reserves were estimated at 141.6 billion tonnes of coal, or nearly 13.2% of the world’s reserves. This data comes from the Statistical Review of World Energy 2020, published annually by BP.

13. Energy Information Administration, 2020.

14. BP Statistical Review of World Energy, June 2020.

15. In France, the share of renewable energy is 11.6% and that of nuclear energy is 40.3%. Ministry of Ecological Transition, *Chiffres clés de l’énergie*, Édition 2020, September 2020.

16. Ibid.

17. 13th Five Year Plan (2016 – 2020).

18. S. Monjon, S. Poncet, *La transition écologique en Chine. Mirage ou virage*

should be remembered that in order to achieve carbon neutrality in 2060, China intends to increase solar power capacity by a factor of 10 and wind and nuclear power capacity by a factor of 7¹⁹.

In addition, as of 1 January 2021, China has prohibited the import of “solid” waste on its territory, even though it has previously received up to half of the world’s total waste. This new tightening of regulations is in line with government policies adopted in recent years, including the ban on the import of 24 types of waste, including textiles and individual and household plastic waste, in 2017. Waste imported into China must now meet multiple criteria (quality, level of contamination). The country’s development has led to an increase in its waste production and by refusing to accept waste from the rest of the world, China intends to protect its environment by limiting the entry of polluting materials onto its soil. This will lead to an increase in the flow of waste to other countries in South-East Asia. For example, since 2018, the import of scrap metal has increased by 14% in Vietnam and a similar situation can be observed in other countries. This subject brings us back to the need to redefine European industrial development models in order to reconsider the materials used in products to move towards recyclable materials, the way products are designed to increase the share of bio-sourced materials, managing the life cycle of products by integrating this topic beginning with the design stage, and especially the way we consume in order to drastically reduce waste production. The current system’s lack of sustainability must push us to find recycling solutions, even if the economic cost remains high.

A systemic approach to industrial and environmental issues

In its Five-Year Plan, published in 2011, the Chinese government announced the need to “build a sustainable, environmentally friendly society”. To achieve its goals, it must strike a balance between economic growth, energy security, and environmental protection. The 2021-2025 Five-Year Plan intends to refocus the country’s economy on the domestic market and emphasises food supply, energy, and technology. The government also aims to reduce the country’s exposure and vulnerability to external shocks. This plan reflects China’s industrial ambition to accelerate scientific and technological development, particularly in the field of quantum technology and high value-added industrial production, while also taking advantage of lower production costs than in other developed countries. This ambition was already part of its “Made in China 2025”²⁰ plan and has been reinforced by US sanctions. China intends to increase its research and development (R&D) expenditure by 7% per year by 2025

vert ?, Paris, Éditions Rue d’Ulm, 2018.

19. As part of China’s 14th Five-Year Plan (2021-2025).

20. “«Made in China 2025» plan unveiled to boost manufacturing”, China News, May 2015.

which would represent a total expenditure of 490 billion euros in 2025.

In comparison, R&D expenditure was €51.8 billion in France in 2018 and about €318 billion for the whole European Union in 2017. Through these measures, the Chinese government aims to pursue the transformation of its economic model, which was based on the over-consumption of energy, the production of low value-added goods, and an abundant labour force for decades, into a model centred on technology, innovation, and capital investment.

China is therefore expanding into various industrial sectors of the future, including that of the electric vehicle. The density of its population is an asset that enables the country to compete with foreign electric vehicle manufacturers for exports while developing its domestic market. As a reminder, China had more than half of the world’s electric vehicle fleet in 2018 and it has adopted a systemic approach to this matter. Electric vehicles solve a pollution issue. To encourage the development of this type of vehicle, the country has set up infrastructure to support their sale as well as production capacity. It has also put in place a strategy to control supplies, notably through the New Silk Roads.

In addition, China has become a major player in the mining industry. The country has developed a domestic mining sector but is also increasingly acquiring resource exploitation rights or sites in Australia, South America, and Africa. Given the resources allocated and the nature of the companies²¹, China is becoming a major player, which will accentuate the dependence of other nations on it²². In contrast, European manufacturers have fallen behind in this sector due to lack of anticipation and a strategic choice to initially focus on solutions other than electric vehicles. Moreover, the European manufacturing base is not necessarily geared toward the production of electric vehicles. For instance, Europe is only just beginning to set up factories to produce batteries for electric vehicles, although this is a key component. Asian countries have a more advanced command of this type of technology, which gives them an advantage in the electric vehicle market. It has also put in place a strategy to control supplies, notably through the Belt and Road Initiative. Furthermore, China has become a major player in the mining industry, which plays a key role in many of the value chains of the energy transition, such as electric vehicles. It has developed a domestic mining activity, but it is also multiplying its acquisitions of resource exploitation rights or sites in Australia, South America and Africa. In terms of resources allocated and nature of the companies, China is

21. The major Chinese mining groups are almost all state-owned or semi-state-owned.

22. J. Yves. “La sécurisation des approvisionnements en métaux stratégiques : entre économie et géopolitique”, *Revue internationale et stratégique*, vol. 84, no. 4, 2011.

becoming a major player in this industry, rapidly increasing the dependence of other nations on its companies' services and materials. For example, according to a study released by the European Commission, China was the world's leading supplier of 30 of the 43 individual critical raw materials. This includes all rare earths and critical raw materials such as magnesium, tungsten, antimony, gallium and germanium. It should be noted, however, that although China is the world's largest supplier, EU Member States can also source certain materials from other producing countries such as Mexico for fluorite, Russia for tungsten and Kazakhstan for phosphorus.

However, it is clear that while China has strong industrial and technological ambitions, it does not have the same commitment to achieve its environmental ambitions. The environmental component is not the subject of significant measures in the 14th Five-Year Plan, which raises questions about the ability of the country to achieve its goals. For instance, unlike the 13th Plan, there is no maximum threshold for energy consumption over five years. The 14th Plan also does not set a maximum threshold for CO₂ emissions, or take steps to prohibit new coal-fired power plant projects. On the contrary, its goals do not represent a significant transformation of China's ambitions. For example, carbon intensity goals remain the same as in the 13th Plan, the energy intensity target is 13.5% for the period 2021-2025 compared to 15% for 2016-2020. At best this will allow the current level of emissions to be maintained, but not drastically reduced.

As the plan does not set a cap on emissions, they will depend on the country's actual growth. According to a study by the Centre for Research on Energy and Clean Air (CREA), China could meet its targets if its growth is between 5 and 6% per year²³. There is also a strong possibility that the country will not meet its goals, as has been the case in the past. For instance, it has exceeded the CO₂ intensity targets set out in its two previous five-year plans, as noted by Carbon Brief²⁴.

Questioning the effectiveness of institutions and legislation

The five-year plans are non-binding guidelines for local authorities. Therefore, the consensus at the central level may not be reflected at the local level, as Mylène Gaulard explains when she talks about the 'myth of an omnipotent state'²⁵. For several years, the inconsistencies between the different levels have been reinforced by the system of evaluation and promotion of local authorities.

The first criteria considered were economic profitability and the preservation of social consensus, i.e. GDP growth and job creation. But environmental policies generally produce results in the long term, while local authorities change every three years. Since the 12th Plan, criteria for environmental protection and energy intensity reduction have been included in the performance evaluation of regional civil servants to ensure that ambitions are translated into concrete actions at the local level.

The National Environmental Protection Agency has very little influence and power against large state-owned enterprises and other local offices. It is under the responsibility of local authorities, which can impose their vision of the missions²⁶. Furthermore, the Ministry of Environmental Protection (later renamed Ministry of Ecology and Environment) has little or no influence on local authorities. We can also observe a very high degree of fragmentation within the environmental bureaucracy. For example, offices exist at different levels (province, county, municipality) but they are independent of each other and may pursue different goals and strategies.

Overlapping areas of authority make conflicts of interest unavoidable, increase obstacles, and lead to inefficiency in decision-making at different levels. A lack of power also has repercussions on the application of laws. In 2018, for instance, according to a survey conducted by the Chinese Ministry of the Environment, 7 out of 10 companies did not comply with environmental standards despite a 2016 law on the taxation of emissions from industrial activities (excluding CO₂ and nuclear waste)²⁷. There are many cases of the law being circumvented which can also be explained by regulations that are sometimes vague, making their implementation complex. For example, the regulation on trucks specifies that vehicles that represent an "obvious danger" must be taken off the road without giving any further details. The combination of strict standards and unclear roles and responsibilities between institutions results in no institution taking real responsibility for controls.

Environmental concerns are becoming a central issue in China with the increase in cancers that have made pollution and its consequences highly visible. However, environmental movements are not coordinated on a national level and tend to be local. The response of authorities to any public concern over a particular factory or project, particularly when it comes to chemicals production plants²⁸, is usually to cancel the project and transfer it to

23. L. Myllyvirta, "China's five-year plan: baby steps towards carbon neutrality", Centre for Research on Energy and Clean Air, mars 2021..

24. "Q&A: What does China's 14th 'five-year plan' mean for climate change?", Carbon Brief, 12 March 2021.

25. M. Gaulard, "La lutte contre le réchauffement climatique en Chine, une nouvelle remise en question du Consensus de Pékin", Développement durable et territoires, Vol. 8, no. 2, July 2017.

26. S. Kuen, "La participation du public en droit environnemental chinois", in C. Eberhard (dir.), *Traduire nos responsabilités planétaires*. Recomposer nos paysages juridiques, Bruylant, 2008.

27. E. Gautreau, "Explain to us... China's paradoxical environmental situation", FranceTVInfo, 8 January 2018.

28. For example, there have been numerous protests against plans to build factories producing chemicals such as paraxylene, a toxic petrochemical, as in 2007 in Xiamen (south-east), in 2011 in Dalian (north-east) and in 2013 in Kunming (south-west). On each occasion, the local authorities eventually

another location. Problematic factories are relocated to less populated and poorer areas. For example, a project rejected by the population of the coastal city of Xiamen (south-east), Fujian province, in 2007 was relocated in the same province to Gulei, a less densely populated area. It should be noted that this factory experienced a first explosion in 2009, without injury, and a second in 2015, injuring at least twenty people²⁹.

Censorship and repression are another reason for limited engagement. Sanctions are applicable to anyone who challenges party policy, and they are imposed as soon as movements are considered dangerous to social and political stability. For example, in 2016, a protest against air pollution in Chengdu (capital of Sichuan province) was dispersed by the police. Protest leaders were arrested and the official media censored³⁰. Some environmental NGOs³¹ have been allowed to develop, but their freedom is restricted, and they operate within the limits set by the central government which generally means that they can carry out actions that are considered harmless, such as raising awareness of environmental issues.

In addition, many organisations do not have legal status and are not eligible for funding. The possibilities for civil society to act are therefore greatly reduced.

Environmental ambitions are absent from EU-China comprehensive agreement

The European Union and China have only recently agreed in principle on a comprehensive investment agreement, even though discussions began in 2013. However, on 4 May 2021, the European Commission announced, through its Vice-President Valdis Dombrovskis, that the ratification process was on hold due to the political climate between the EU and China. This agreement had raised several questions on the economic front, but above all there was a serious lack of ambition on the environment. While it is true that the agreement establishes a reciprocal obligation to implement the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, it should be noted that the Paris Agreement does not commit to results³². While China wishes to present itself as a leader in the fight against global warming, the European Union is struggling to position itself as a geopolitical power and to make its voice heard on the en-

vironmental issue.

The agreement aims to open the respective markets more widely to mutual investments. China will therefore benefit from greater access to Europe's energy and manufacturing sectors, and, in return, it will commit to facilitating the entry of European companies into promising new markets such as clean vehicles, health, finance, and the cloud. Very few environmental commitments were included, even though there was an urgent need to build common and transnational solutions on the matter. There is also a need to rebalance trade between European companies constrained by high environmental standards and Chinese companies, some of which are subsidised by the State, which practice environmental and social dumping.

The agreement can be seen as Europe's desire to harmonise the bilateral treaties signed by the different Member States with China. There is also a question of reciprocity in access to the market and to companies. In the last few years, several European flagship companies have been acquired by China, such as Volvo in Sweden, Pirelli in Italy, Lanvin in France, and Kuka in Germany. Between 2010 and 2020, Chinese groups made 650 acquisitions in Europe, including 174 in Germany, 102 in the UK, and 72 in France. Of the 72 French acquisitions, 40% were made by conglomerates that are wholly or partly owned by the Chinese state³³. Chinese companies took advantage of the euro crisis in 2008/2009 to make several acquisitions in Europe, particularly firms in crisis. The global treaty could increase Chinese acquisitions in Europe, even if the European Commission wants additional tools to better protect European industries³⁴. For example, on 11 October 2020, a screening mechanism for direct foreign investment came into effect at the European level. It is an undeniable step forward and is based on an exchange of information between Member States.

Each state remains free to evaluate whether investment presents a risk or not. However, this mechanism does not apply to all investments, but only those likely to jeopardize security or public order. It will therefore be necessary to examine the use of this mechanism by the Member States (only 12 of which have a national filtering mechanism) and the reactions of the European Commission. The European view is that the mechanism should not be a means of preventing the free movement of capital for purely economic reasons, but some Member States may see it as a means of circumventing European rules to go further than simply protecting national security. Furthermore, Chinese acquisitions in Europe are diverse and therefore raise questions about the definition of strategic assets. It is therefore possible to divide Chinese invest-

abandoned the projects concerned.

29. "Violent incendie après une explosion dans une usine chimique", *Courrier international*, 7 April 2015.

30. G. Pitron, "En Chine, la ligne rouge du virage vert", *Le Monde diplomatique*, July 2017.

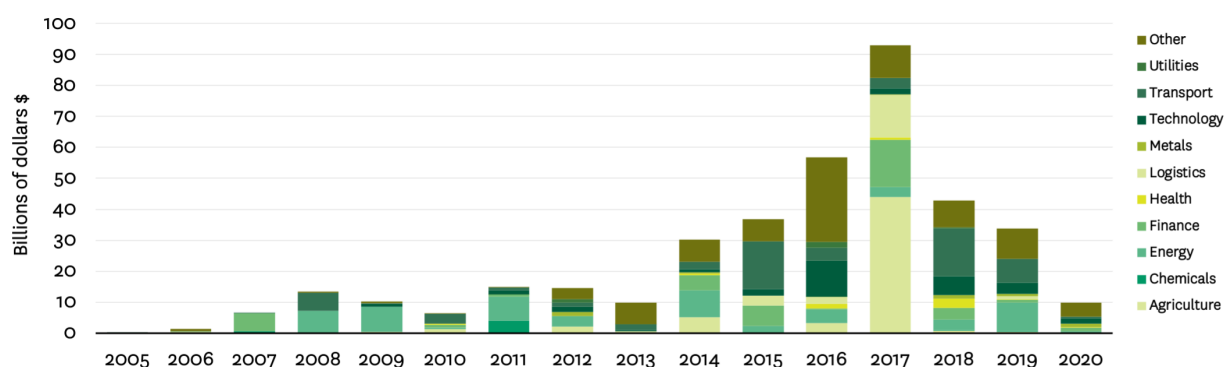
31. NGO with official status (registered with the Ministry of Civil Affairs as a social organisation), NGO with semi-official status (registered as a company), NGO with unofficial status (no official recognition or existence), governmental NGOs established by government agencies (hybrid status specific to China).

32. A. Canonne, M. Combes, N. Roux, I. Verheecke, "Accord UE-Chine : l'UE rassure les investisseurs au mépris des droits humains", *Note de décryptage*, AITEC – ATTAC France, April 2021.

33. J. Zaugg, "Comment la Chine fait main basse sur les pépites européennes", *Les Échos*, April 2021.

34. European Commission, "Mise à jour de la stratégie industrielle de 2020 : construire un marché unique plus solide pour soutenir la reprise en Europe", *Press Release*, European commission, 5 May 2021.

FIGURE 1 • CHINESE INVESTMENT IN THE EUROPEAN UNION (28), BY SECTOR



ments as follows:

1. Achieving technological breakthroughs: acquiring technologies, know-how and skills³⁵ to limit R&D efforts, thus saving time and money and focusing financial and human resources on the technologies of tomorrow such as clean vehicles, robotics, quantum, etc.
2. Ensuring food safety: numerous food scandals have affected China, particularly in infant food, which has led the country to make foreign acquisitions in this area to secure its supplies.
3. Acquiring a brand image: the acquisition of well-known and established European brands is a guarantee of quality because they often have a good brand image and are also a means of gaining a foothold in the European market, particularly in the automobile or apparel sector with so-called “accessible luxury” brands such as the SMCP³⁶ group or luxury brands such as Sonia Rykiel and Lanvin.

Even if the European market is open, European companies are subject to restrictions when investing in China. The rules have recently evolved in China, but for several years companies wishing to invest in China have been obliged to create joint ventures with local companies and to accept technology transfers. Since 1 January 2020, the Foreign Investment Law replaces three previous laws and lays out restrictions for foreign investment. Strategic sectors which relate to state sovereignty, such as information services, are closed to foreign companies. China has banned certain companies from entering its market and has worked towards the emergence of national competitors such as Baidu covering Google’s domains, Alibaba covering Amazon’s, Sina Weibo covering Twitter’s, etc. Other sectors such as telecommunications are also subject to investment restrictions.

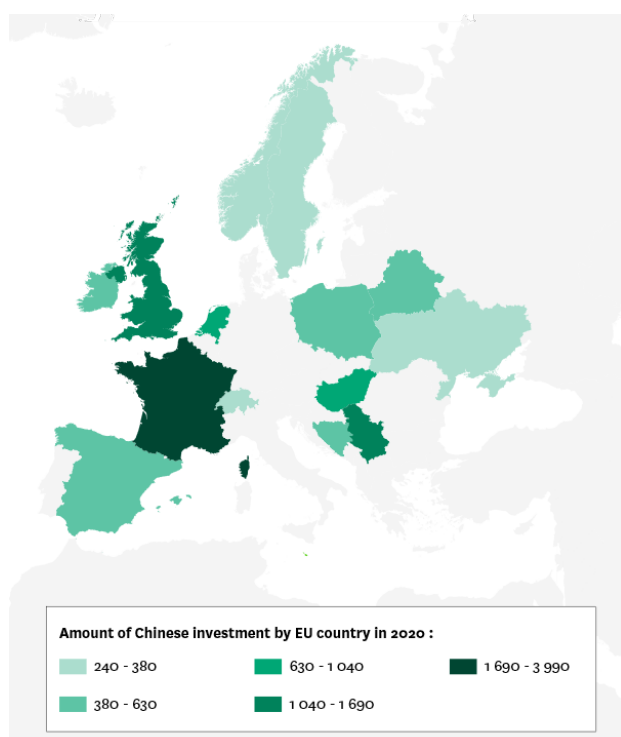
One of the interests of the agreement was to review several years in which China has focused on developing bilateral relations with EU member countries. The projects were of various nature, but mainly concerned infrastructures. In Italy, for example, through the New Silk Roads, the ports of Genoa and Trieste were made available to Chinese companies wishing to establish themselves in Europe. In Greece, the port of Piraeus was turned over to the shipping company Cosco. In Spain, Cosco controls the ports of Bilbao and Valencia. As a result, China has an influential strategy on the Member States that could ultimately challenge European cohesion. The global agreement can therefore be seen as a means for the European Commission to avoid bypassing European authorities.

In addition to environmental issues, this agreement raises economic questions. It seems unbalanced since it binds the European Union more than China due to the nature of the Chinese system. While China has committed to joining the International Labour Organisation (ILO), it rarely respects all commitments made in international agreements. It has repeatedly violated its trade commitments in order to pursue its political and economic interests, such as when Australia denounced China’s policies in Xinjiang, Hong Kong, and Taiwan in spring 2021. As a reminder, since 2001 and its entry in the World Trade Organisation (WTO), China has not honored its commitments to respect human rights. And so, a geopolitical reading of the agreement reminds us that the European Union is not a political organisation and that it struggles to define a geopolitical ambition which unites the 27 Member States. Trade policy must be a foreign policy tool. This agreement, if it goes ahead as it is, will show Europe’s weak strategic vision, in contrast to China, which has a geopolitical vision. It will also expose the nations’ lack of ambition regarding environmental matters and the transformation of industrial models in order to achieve the established goals.

35. S. Guillou, “Doit-on s’inquiéter de la stratégie industrielle de la Chine ?”, OFCE, Policy Brief n°31, January 2018.

36. The SMCP group comprises the brands Sandro, Maje, Claudie Pierlot and De Fursac.

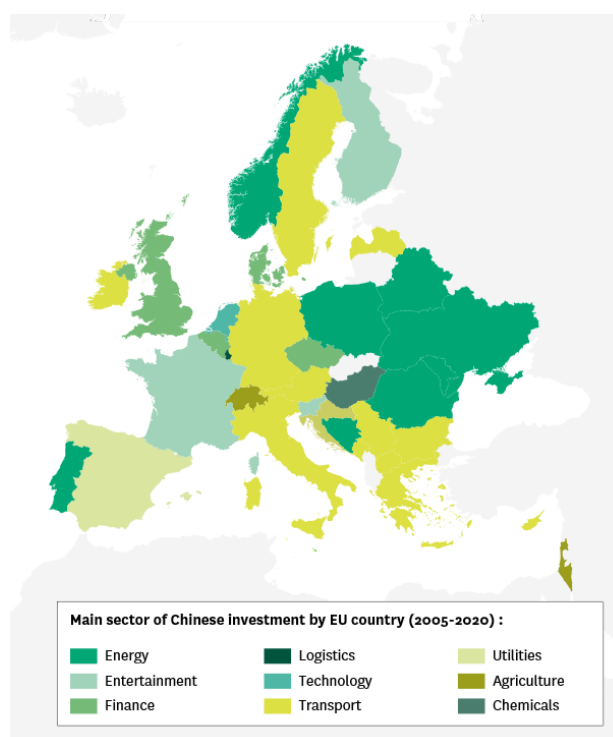
FIGURE 2 • AMOUNT OF CHINESE INVESTMENT BY EU COUNTRY IN 2020³⁷



Conclusion

It is still early to judge the effectiveness of China's environmental policy considering the progress the country still has to make. Moreover, it is possible to address the environmental issue more broadly by asking whether States have really become aware of the transformation required to achieve environmental goals. The more time passes, more drastic concessions will be required to achieve these goals. The emergence of a truly ecological society will require a deeper questioning of the functioning of the Chinese economy and institutions, starting with the end of the coal-based production model. In addition, the transformation of the Chinese model is not just a concern for China, given the current interdependence of economies and the global nature of the environmental problem. In other words, the environmental issue calls for a profound transformation of the production, distribution, and consumption models of all Western countries.

FIGURE 3 • MAIN SECTOR OF CHINESE INVESTMENT (FDI) BY EU COUNTRY (2005-2020)⁴⁰



In addition to the coal issue, China needs to improve the efficiency of its industry, which is more energy intensive than world standards. It also needs to build sufficient energy infrastructure and put effort into innovating in the right areas, starting with the energy sector. The systemic approach is key, as the example of the electric vehicle shows. However, care must be taken to not create new environmental problems by aiming for carbon neutrality or to relocate the problem to other countries, as Western countries have partially done with the phenomenon of relocation.

China's environmental ambitions also reflect a desire to be a leader in this area and therefore address geopolitical concerns. There is still a long way to go, but the fight against global warming is not and cannot be a competition. Each country must strive to reduce its overall environmental impact, not merely to achieve carbon neutrality, and to do so in a spirit of cooperation with other nations and to preserve the world's shared resources.

37. Source: The American Enterprise Institute, *China global investment tracker*, Autumn 2020, consulted on 17 June 2021.



Susanne Dröge • Senior Fellow, Global Issues program at the German Institute for International and Security Affairs (SWP)

The EU and China: Climate and Trade Increasingly Intertwined

The EU and China - different ambitions and actions on climate

The interlinkages between trade and climate change have risen to the top of the international negotiations on climate cooperation. This effect is partly caused by the Green Deal of the European Commission, by the revival of international climate and trade talks after the US elections 2020, and by the increasing knowledge and data that show that trade flows can both undermine and support climate action. Trade flows cause transport emissions and they help to disseminate emission-intensive goods and practises, but trade flows can also help to speed up deployment of climate-friendly technologies.

In Europe, climate protection to an increasing degree becomes part of political projects like industrial strategies, social justice and post Pandemic recovery^{1,2}. The EU also aims at greening financial market regulation and government procurement rules as well as a growth stimulus. The European Union has decided to reduce its GHG-Emission by 55 percent in 2030 and to become climate-neutral until 2050.

China, on the contrary, has no such concrete ambitions in place yet. China's latest five-year plan does not show any intensification of climate protection activities. Rather, it repeats the level of ambition from the last five-year plan (minus 18% carbon intensity).

As China is the most important trade partner of the EU (16% in 2020³), it matters for both parties, how strict or

lax they implement constraints on fossil fuel consumption and other key emission sources. The trade flows between the EU and China will be influenced by carbon pricing, regulation and standards that are implemented domestically. Moreover, the EU is currently redefining its foreign policy towards China. Given that there is a fundamentally different approach towards human rights, strong economic competition as well as a need for international and bilateral cooperation on climate protection with China, the relationship is complex⁴. The European Union thus is seeking new approaches to connect with China on climate policy, while at the same time to signal that red lines exist with respect to human rights and intellectual property rights violations.

Over the last decades, many production processes have been outsourced to China and the People's Republic was successful in becoming the global economic powerhouse with an increase in world income from the end of the 1970 of 5% to over 17% in 2016⁵. Yet, this immense economic success came along with high emissions and nowadays China has a share in global emissions of around 28%. The highest share of Chinese emissions stems from coal (70% in 2019⁶), cement production is the sector with the highest single share in overall CO₂-emissions (0.8% of chinese emissions in 2019). The 2020 economic recovery after the Pandemic was driven by carbon-intensive industries⁷. The Chinese government made an announcement on its future climate targets last September. Before 2030 Beijing aims at peaking the domestic emissions and before 2060 it plans for carbon (not climate) neutrality⁸.

The EU is in the process of reforming its legislative activities to deliver on the 2030 climate target of minus 55% (compared to 1990 emissions) and climate neutrality by 2050. The new proposal by the Commission for an EU trade strategy, published in February, holds a potential, too, to create more momentum for climate action in the EU and internationally. In the Trade Policy Review the Commission emphasises that the EU trade policy should react to rising uncertainty due to political and geo-economic tensions, in particular the rapid rise of China, global technological evolutions and the pandemic. Climate change, biodiversity loss and environmental degradation need to be tackled with a green transition. The proposal also signals to important trade partners like China that

1. European Commission, "The EU budget powering the recovery plan for Europe", Communication from the Commission, May 2020.
2. European Commission, "A Union of vitality in a world of fragility", Annexes - Commission Work Programme 2021, 2020.
3. Client and Supplier Countries of the EU27 in Merchandise Trade (value %) (2020, excluding intra-EU trade), European Commission, DG TRADE.

4. J. Oertel, J. Tollmann, B. Tsang, "Climate superpowers: How the EU and China can compete and cooperate for a green future", European Council on Foreign Relations, January 2021.
5. S. Brakman, C. van Marrewijk, "China: An Economic powerhouse that depends on the Rest of The World - RSA Main", January 2020.
6. Global Carbon Project, 2019.
7. M. Grant, H. Pitt, K. Larsen, "Preliminary 2020 Greenhouse Gas Emissions Estimates for China", Rhodium Group, 2021.
8. The neutrality targets take different points of reference. The EU is aiming at climate neutrality. This comprises all Greenhouse Gases. The goal of carbon neutrality is aiming at net-zero CO₂-emissions only. Thus, it is not as ambitious as climate or GHG-neutrality. See Ö. Geden, J. Rogelj, A. Cowie et al., "Three ways to improve net-zero emissions targets", Nature, 2021

the EU actively will keep up its own interests by increasing its strategic autonomy, with the Green Deal agenda and the intention to keep up leadership, own values and engagement⁹.

As part of the legislative climate package (“Fit for 55”), the Commission has planned for a concrete proposal for a Carbon Border Adjustment Mechanism (CBAM) announced in July 2021. The idea of charging a CO₂-price for imported goods has brought carbon pricing to the attention of trade policy experts and policymakers. The CBAM is supposed to address the risk of carbon leakage for energy intensive industries. The ultimate goal is to prevent the relocation of emissions from the EU to third countries. So far, the EU applies free allowance allocation and electricity cost compensation to that end. Sectors like cement, steel, aluminium, and chemicals receive up to 100% emission certificates for free, depending on their actual efficiency, exposure to trade and their CO₂-intensity. Moreover, with the CBAM the Commission hopes to make an impression on countries that do not show much ambition in following the EU climate policy example¹⁰.

By November 2021, when the 26th Conference of the Parties (COP 26) takes place in Glasgow, all parties to the Paris Agreement are asked for their renewed nationally determined contributions (NDCs) and long-term climate plans. China still has to make its announcements an official NDC.

In the mix of trade and climate policy approaches by the EU towards China, the CBAM could potentially play an interesting role. Whether it will become a game changer in EU China climate relations will depend on a number of factors, such as human rights issues, EU-China intellectual property rights and investment negotiations, the political pressure from US trade and climate policy put on China. The CBAM could facilitate more cooperation in dealing with emissions from energy intensive industries and the traded goods from sectors like steel and cement. Cement production alone is responsible for around 8 % of global CO₂-emissions¹¹ and China produces the largest part of cement globally, about 60 %. Yet, given the trade tensions that already exist between the EU and China, the CBAM could also add another complexity to the list of unresolved issues between the two players.

Connecting 2021 to the mid-term

The climate policy decisions in the EU and in China (and other big economies) this year will be key for what can be achieved globally by 2030 and beyond. The EU has

already a longer list of proposals for legislation to implement the Green Deal, including the reform of the EU ETS, the Energy Tax Directive, and more¹². The full “Fit for 55” package will induce climate action with a view to the new climate targets. Also, the EU managed to couple the funds for the economic recovery after the Pandemic¹³ with its Green Deal and with the new EU multiannual financial framework. Public money will thus be partly earmarked for climate policy purposes.

As the US government returned to the international negotiation table¹⁴, started its own very ambitious climate policy agenda and announced a similar set of climate targets as the EU did¹⁵, there is a stronger signal now that transatlantic cooperation will set the pace when it comes to creating markets for climate-friendly products. The US plans for 100% “pollution-free” electricity production by 2035¹⁶ and stricter regulation for the transport sector, buildings and industry will be added. If the plans materialise, this would help to create critical market sizes for green products in the US along with the EU for the next decade.

China, on the other hand, has not yet decided to speed up climate protection. The country holds on to a capacity increase in coal combustion^{17,18}, investments that will last for at least two or three decades. As China consumes around 50 % of global coal supply alone for this purpose¹⁹, a decline in coal use would make a huge difference for global emissions. Moreover, fossil fuel capacities are promoted by Beijing also externally through its Belt and Road Initiative that reaches out to its neighbouring countries, and also to Africa and the Balkan countries²⁰. Currently the forecasts for China’s emissions trajectory are rather pointing to insufficient and slow progress towards emissions reduction²¹. This is contradicted to a certain extent by the high investment in renewable energy, where China is a world leader in absolute and relative terms.

In 2021, the international climate policy is fully fo-

9. European Commission, “Trade Policy Review - An Open, Sustainable and Assertive Trade Policy”, Communication, 2021.

10. S. Pickstone, “Timmermans says he hopes not to use CBAM against China” Ends Europe, May 2021.

11. “Q&A: Why cement emissions matter for climate change”, Carbon Brief, September 2018.

12. European Commission, “Trade Policy Review - An Open, Sustainable and Assertive Trade Policy”, Communication, 2021.

13. European Council, “Special Meeting of the European Council”, Conclusions du Conseil, 17-21 July 2020.

14. “Executive Order on Protecting Public Health and the Environment and restoring Science to Tackle the Climate Crisis”, The White House, 20 January 2021.

15. “Executive Order on Tackling the Climate Crisis at Home and Abroad”, The White House, 27 January 2021.

16. M. Darby, I. Gerretsen, “Which countries have a net zero carbon goal?”, 2019.

17. In February 2020, China had about 250 GW of new coal plants under development. Reuters Staff, “China’s new coal power plant capacity in 2020 more than 3 times rest of world’s - study”, Reuters, February 2021.

18. The latest Chinese FYP (2021-2025) does not plan for a decrease during 2021-2025, as even if moderate, the coal consumption growth is planned to be positive (0.1% to 0.9% per year). See “Q&A: What does China’s 14th five year plan mean for climate change?”, Carbon Brief, March 2021.

19. BP Statistical Review of World Energy, BP, June 2020.

20. [ndlr] See in the issue the article of H. Chen and C. Springer titled “China’s Uneven Regional Energy Investments”, page 92.

21. Carbon Brief, op. cit.

cused on the COP 26 in November in Glasgow. By then all parties to the Paris Agreement are supposed to have handed in their new climate commitments for the mid- and the long-term. Thus, major summits, like the Leaders Climate Summit in April 2021, the G7 summit in June, the G20 Summit in October are having a role in motivating laggards to bring their offers to the table. Finishing the Paris Rulebook, by agreeing on the settings for international emissions trading and the rules for transparent reporting on emissions data, as well as reliable financial commitments to help developing countries, belong to the key issues that need to be addressed. The EU plus the UK and the US are pairing²² to build a renewed coalition of progressive countries that drive climate protection. Trade cooperation is one of the building blocks, it seems.

Also in 2021, the international trade system of the WTO is at the centre of attention of multilateralism. Reforms are overdue. Decades in which new regional and bilateral trade arrangements flourished, the US blockage of the dispute settlement system, with an increasing number of anti-dumping cases, the EU-China conflict about the status of China as a market economy, and many more issues have undermined the functioning of the multilateral trade order. The plan to negotiate a Doha Development round was put on hold - a frustrating situation for developing country members.

After COP 26, the WTO will hold its 12th Ministerial Conference and hopes are high that some of the issues, in particular the needs for a new round of trade talks that help developing countries' agendas, can be resolved. But also the pressure is rising at the WTO to help countries in implementing their NDCs and defining a role for the WTO in this respect²³. With the EU's plans to introduce carbon border adjustments for some energy-intensive sectors, however, the WTO system and its forums will experience another stress test. More proactive proposals, in particular the revival of talks about a plurilateral environmental goods agreement (EGA), are emerging in the debates²⁴. Under an EGA, tariffs for climate-friendly technologies and goods could be lowered, and trade could add to a speedier implementation of national climate policies. If the WTO and the settings of regional and bilateral trade talks can become "greener", e.g. by also considering the climate targets and measures, by using reporting tools for climate policies that relate to trade and by formulating common interests on how reforms could help advancing climate protection, this would increase chances that the climate policy implementation would gain speed with a view to 2030 targets.

22. United States Department of State, Joint declaration : "The United States and the European Union Commit to Greater Cooperation to Counter the Climate Crisis", 2021.

23. C. Deere Birkbeck, "How can the WTO and its Ministerial Conference in 2021 be used to support climate action?", One Earth, Vol 4, May 2021.

24. M. Sugathan, "Addressing Energy Efficiency Products in the Environmental Goods Agreement", International Centre for Trade and Sustainable Development, 2015.

Carbon embedded in trade and the EU CBAM

Traded products cause carbon emissions in the country of production. These emissions are not accounted for in countries of consumption. Yet, the overall picture shows that industrialised countries emissions balances benefitted over time from the outsourcing of production to developing countries (Figure 1²⁵).

Particular attention has been paid by researchers to the flows of CO₂ since the 1990s globalisation kick-off. As a pattern, the industrialised countries are mostly net importers of embedded carbon, while emerging economies and some developing countries are net exporters. Peters and Hertwich described this effect from international division of labour as carbon leakage²⁶.

China's high share in global emissions has evolved both from its domestic growth, driven also by the increasing share of China in international trade²⁷. In 2014, 26% of the EU-28 emissions relating to final demand were emitted in China. They were embedded in Chinese goods delivered to the EU. Outsourcing CO₂-intensive activities to China, and importing the related goods, contributed to Europe's decline in emissions and China's increase. This also holds for other countries²⁸.

The EU CBAM will have an influence on these trade flows. The CBAM is supposed to prevent future relocation of industries outside the EU or changes in trade flows due to asymmetric climate regulations. This type of relocation would undermine the EU effort to reduce emissions from EU production. However, although the EU is the third largest trading partner worldwide, going it alone will be risky, from a legal, a political and an economic point of view²⁹.

The CBAM will most likely start with a few sectors in order to test the approach. Among those to be included are cement and steel, often mentioned in consultations. Both contribute large shares, respectively about 6% and about 8%³⁰, to global emissions and range among the sectors at risk of leakage³¹ and are traded between the EU and Chi-

25. Source: Peters et al, Global Carbon Project.

26. G. P. Peters, E. G. Hertwich, "CO₂ Embodied in International Trade with Implications for Global Climate Policy", Environ. Sci. Technol., 2008.

27. S. Heli, "CO₂ emissions embodied in EU-China trade and carbon border tax", 2020.

28. K. He, E. G. Hertwich, "The flow of embodied carbon through the economies of China, the European Union, and the United States", Resources, Conservation and Recycling, 2019.

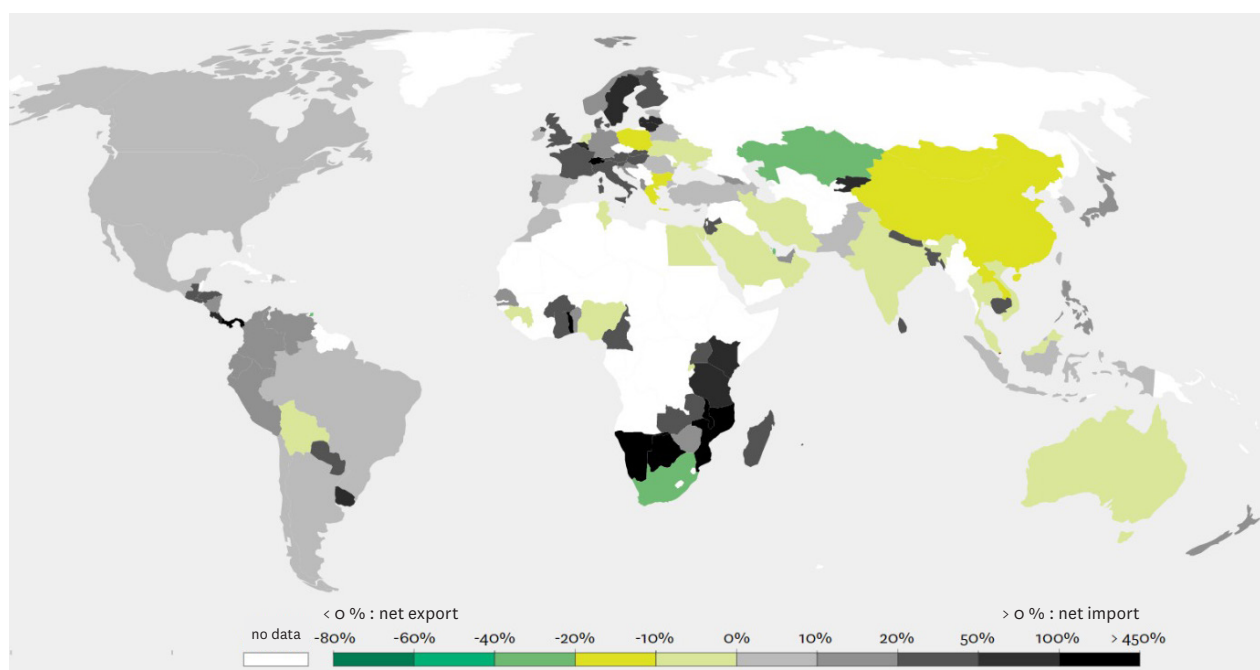
29. L. Hook, "John Kerry warns EU against carbon border tax", Financial Times, mars 2021 ; G. Zachmann, B. McWilliams, "A European Carbon Border Tax: Much Pain, Little Gain", Policy Contribution, May 2020.

30. C. Hoffman, M. Van Hoey, B. Zeumer, "Decarbonization challenge for steel", McKinsey, June 2020.

31. "Carbon leakage refers to the situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions. The risk of carbon leakage may be higher in certain ener-

FIGURE 1 • SHARE OF CARBON DIOXIDE (CO₂) EMISSIONS EMBEDDED IN INTERNATIONAL TRADE IMPORTS AND EXPORTS IN

2018



149

na. The full list of at-risk-sectors is longer, including chemicals, fertilisers, aluminium and other energy-intensive industries. An extension of the CBAM coverage is unclear, yet the legal draft is supposed to be “sector-neutral”, so that an extension will not need a new legal proposal.

The details of the EU CBAM legislative proposal are still unclear, some features are very likely though. The roadmap³², issued by the Commission in March 2020, included different ways to connect a border levy to EU internal policy approaches to price CO₂. They include a border tax, a customs duty and an extension of the EU ETS. The key carbon pricing instrument in the EU is the EU ETS, while a CO₂ tax is not likely to emerge at all, however some of the member states have individual CO₂-taxes in place³³. A virtual EU ETS for importers is a likely outcome for the CBAM design. It would mean that importers will be paying the EU ETS CO₂ price, but will not participate in trading not carbon trade the allowances.

For the mid to long-term, the CBAM’s success will be mirrored in a decreasing differential between trade partners - it would be successful if it eventually phases out, as trade partners follow the EU example and reduce emissions. Another CBAM potential is that it could trigger more transparency in emissions data around the globe, because companies and countries want to show that they improve their emissions performance or even become cli-

mate-neutral. Last but not least, international standards for certification and monitoring of emissions could be pushed this way.

The CBAM as intended by the EU will probably not cover the full carbon footprint of traded goods (from cradle to grave) but rather the direct emissions and those from electricity use, as it is the case with the EU ETS.

A calculation of a CBAM for imports will have to take into account several elements. It should relate to the carbon content of imports, that is, some data and assumptions are needed on how much CO₂ is caused during the production abroad. In order to comply with WTO rules, there should be no discrimination between trade partners of the EU. Thus, using the EU-average for calculating direct CO₂ emissions of a sector would be a good starting point to calculate how much CO₂ is embedded in an imported good. For indirect emissions from electricity use, the calculation could use the average country-of-origin CO₂-intensity. For both assumptions, the EU average for direct emissions and the country-of origin emissions from electricity, the EU should allow that companies individually prove that they are performing better than these averages. Moreover, in order to not create double protection for European producers through the CBAM, the degree of free allowance allocation needs to be subtracted from the calculation, either as a credit for the carbon price that is used or as a credit for the assumed amount of CO₂ that is embedded in imports. Also the price that will be charged at the border under a virtual ETS, would need to be reduced by a CO₂ price, if any, in the exporting country. It is very important to avoid double pricing for imported

gy-intensive industries”, European Commission, Climate action, EU ETS.

32. Commission Européenne, “EU Green Deal (carbon border adjustment mechanism). Inception Impact Assessment”, 2020.

33. For instance France has a CO₂-tax since 2014 on fossil fuels. Sweden has a CO₂ tax since 1991.

products.

Implications for and reactions by China

A rough estimation of the carbon price that Chinese firms would face under a CBAM for the steel sector can be made based on the latest trade data for steel. The steel imports from China to the EU-27 were worth 1.7 billion Euros on average in 2019 and 2020. The traded weight in tonnes was 1.9 million tonnes in the 2 years average. If a CBAM would apply the average EU CO₂-intensity of 1.3 tonnes of CO₂ per tonne of steel (NACE 2410³⁴), then the imported CO₂ from China from steel alone would add up to 2.5 million tonnes per year. Putting a price of 25 euros would in theory mean a 62,5 million euros bill. In light of the calculation details, however, this has to be corrected for free allowances that the EU steelmakers have received. The steel industry in Europe has received up to 100 percent free allowances during the last years. As long as this is the case, the Chinese imports would not be charged. Yet, the future decrease in free allocation, as planned for under the EU ETS until 2030, will define whether or not a CBAM will be charged in the future. Also, China has started an ETS itself and the CO₂-price has to be credited for. Moreover, the trade in steel is more complex than the focus on imports suggests. There is considerable export of steel from the EU, including export of steel products to China³⁵. Thus, the steel industry is also subject to carbon leakage outside Europe, which occurs if it loses market shares in other markets to producers with higher CO₂-intensity of steel products.

A number of reactions could arise from this first test of the CBAM for steel. China's industry is carbon-intensive. So the assumption that the EU average will be used to calculate direct emissions for the CBAM could be in favour of China's producers. But also Chinese producers - mostly state-owned enterprises - could reshuffle clean energy input to exported goods to bring down the CBAM bill. If cement or steel is being produced with renewable power (for steel this is relevant mostly for recycling of scrap steel), then a proof that the CO₂-intensity of the electricity for exported goods is below Chinese average could help reduce the CBAM price. Reshuffling as such is not desirable from a climate policy point of view as it would mean that fossil sources will simply be used for other purposes and there is only limited reduction of emissions as a reaction to the CBAM.

Also, China could consider diverting its deliveries to the EU via countries that do not have to pay the CBAM, either because they have negligible amounts they export to the EU, or because they are exempt due to their status as Least Developed Country (LDC). Such exemptions are likely to be part of the CBAM design in order not to burden poor countries and to keep the fairness principle under the Paris Agreement.

The EU has a rather long history of steel trade conflicts with China³⁶. The EU claims that the Chinese state-owned companies export overcapacities that they sell at prices below production cost to Europe³⁷. If this kind of dumping can be proven, the WTO rules allow for countervailing measures. The EU has implemented countervailing duties on Chinese steel products and has launched new investigations last year. The issue has not yet been resolved under the WTO dispute settlement system or elsewhere.

The CBAM would thus add to the tensions. It will be regarded by Chinese officials as another means to suppress Chinese steel (and also other) imports to the EU. It is highly likely that the CBAM will be politicised. In international forums and EU-China-meetings first, partly fierce reactions emerge³⁸. China together with other members of the BASIC group (Brazil, South Africa, India) protested against the EU plan³⁹.

The way forward

The EU relationship with China is in a phase of strategic reorientation. The threefold characterisation of China by the EU as a political rival, competitor and cooperation partner shows that the complexity of handling the ties with China are increasing. Using climate and trade policy to address this on an issue-by-issue basis may become more relevant to EU policymakers. The CBAM thus could become a tool to put economic pressure on China, for instance used in order to push Beijing to reduce coal combustion. 2021 is a very important year in this respect. The upcoming high-level meetings will show how far the EU and China will be able to agree on climate cooperation in light of the mounting pressures put on China, and on their trade priorities in a manner that is mutually beneficial.

34. Eurostat, "Statistical classification of economic activities in the European Community", NACE code 2410 "Manufacture of basic iron and steel and of ferro-alloys".

35. 20.5 millions tons of finished steel products exported from the EU in 2019, almost as much as the import of finished steel products (25.3 millions). China is the 4th export destination, 2020 *European Steel in Figures*, Eurofer, 2020.

36. European Commission, "General overview of active WTO dispute settlement cases involving the EU as complainant or defendant and of active cases under the Trade Barriers Regulation", 2013.

37. European Commission, "The European Union's Measures Against Dumped and Subsidised Imports of Solar Panels from China", 2016.

38. K.Taylor, "Chinese president slams EU carbon border levy in call with Macron, Merkel", EURACTIV, April 2021.

39. South African Government, "Joint Statement issued at the conclusion of the 30th BASIC Ministerial Meeting on Climate Change hosted by India on 8th April 2021", 2021.



China's Climate Ambitions

Laurent Fabius, Amy Dahan, Thibaud Voïta, Jean-Paul Maréchal, Michel Aglietta, Pierre Charbonnier and David Levai

Discussion with Adam Tooze, Enrico Letta, Laurence Tubiana, Jason Bordoff and Alex Halliday

The Challenges and Contradictions of China's Ecological Transition

Philip Andrews-Speed, Jean-François Di Meglio, Michal Meidan, Anders Hove, Mathilde Teissonnière, Han Chen, Cecilia Springer, Clémence Pèlerin and Hugo Marciot

An "Ecological Civilization" ?

Yifei Li, Judith Shapiro, Stéphanie Monjon, Léa Boudinet, Federico Cugurullo, Élodie Renée, Mathieu Glachant, Simon Touboul, Anaïs Voy-Gillis and Susanne Dröge