The dark side of ambition: side-effects of China's climate policy

Hongzhang Xu1,2,3, Aaron Tang1,3 and Jamie Pittock1,3

1 Fenner School of Environment and Society, Building 141, 48 Linnaeus Way, The Australian National University, Acton, ACT, 2600, Australia
2 Australian Centre on China in the World, Building 188, Fellows Lane, The Australian National University, Canberra, ACT, 2600, Australia
3 ANU Institute for Climate, Energy & Disaster Solutions, Fenner School of Society & Environment, Building 141, Linnaeus Way, The Australian National University, Acton, ACT 2601, Australia

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Abstract

China’s latest commitments to the Paris Agreement have attracted great attention. Scholars have questioned the feasibility of China’s pledges to peak emissions before 2030 and achieve carbon neutrality by 2060. To achieve these goals, China has resorted to extreme emissions reduction actions. However, side-effects of China’s climate ambition have been largely overlooked. An intersectional and just transitions perspective is critical to examine limits and trade-offs for broad societal goals. This paper outlines five policy approaches that can help limit adverse side-effects and unlock broader social benefits.

1. China’s climate contradiction

China’s climate change policy leadership ambition is growing. In 2015, under its first nationally determined contribution (NDC), China committed to peak CO₂ emissions by 2030. After committing to achieve carbon neutrality by 2060, China has strengthened existing climate targets and announced new climate targets at the 2020 Climate Ambition Summit, namely by 2030 to: (a) lower by more than 65% CO₂ emissions per unit of gross domestic production, (b) increase the share of non-fossil fuels in primary energy consumption to 25%, and (c) expand forest stock by 6 billion cubic meters compared to 2005.[1, 2]. China has stated that its installed capacity of solar and wind power will be over 12 billion kilowatts by 2030.[1,2] Chinese renewable energy generation, capacity, and investment have increased. Because of ongoing emissions-intensive activity, China has resorted to extreme emissions reduction policies to meet ambitious climate targets.

However, China’s carbon-intensive activities contradict its climate change mitigation ambition.[5, 6] China is still heavily reliant on fossil fuels, accounting for 88% of total energy consumption in 2014.[7] and 84.7% of primary energy consumption in 2019.[8] China’s coal consumption contributed to 52% of global CO₂ emissions from coal combustion in 2015.[9]. Moreover, China’s response to COVID-19 has increased investment in emissions-intensive industries, not less.[10, 11] Another 100 GW of coal-fired plants are currently under construction.[5]. Because of ongoing emissions-intensive activity, China has resorted to extreme emissions reduction policies to meet ambitious climate targets.
2. Side-effects of China’s climate governance

However, many of China’s extreme climate actions come with side-effects—they are actively detrimental to other environmental and social goals (table 1) despite being effective instruments of emissions reduction. These actions have already threatened many species and will put more pressure on fragile ecosystems in many regions. Many actions also bring high social costs. These risks are especially worrisome without careful holistic planning and policy. For example, some actions may trigger power outages and restrictions [12], increase unemployment (e.g. employment in coal industries can decline by 75% [13]), compromise the interests of extractive communities [14], and negatively impact regional development, especially northeastern China [12].

China’s low-carbon transition needs to be assessed from a just transition lens to examine its benefits, limits, and potential conflicts [15]. Just transitions are not just a matter of ensuring justice for those embedded in fossil-based industries of the past. Justice for actors within the transition, for example, those related to new renewable industries, are just as important [16], but have been overlooked.

3. Achieving just transition needs with intersectional climate policy

Creating and assessing climate policy with single overriding metrics, such as emissions-intensive investment or renewable energy industries, overlooks critical social outcomes and compromises just transitions. Focus on single overriding metrics may misrepresent China’s policy process [58]. For
Forced resettlement that reduces quality of life, with Carbon sequestration and capture need to offset the

Involuntary resettlement of diverse and dispersed Noise and flicker generated by turbines (particularly Large wind farms can affect local weather and climate

Most resettlers endure land loss, unemployment, Rare earth mining, high water usage, dust emissions Some local residents say they are negatively impacted, Solar expansion has resulted in land loss via illegal occu-

Loss of aquatic biodiversity, fragmentation of habit-

Excessive hydropower construction that leads to oversupply and curtailment [17, 18]. (a) Excessive hydropower construction that leads to oversupply and curtailment [17, 18].

(b) Loss of aquatic biodiversity, fragmentation of habitats and impacts on downstream floodplains, wetlands, estuarine, adjacent marine ecosystems [17, 19], and fisheries [20–22].

(c) Forced resettlement that reduces quality of life, with one-third of those resettled living in severe poverty [23, 24].

(a) Carbon sequestration and capture need to offset the carbon emitted by fossil fuels constituting 7%–35% of total energy generation by 2050.

(b) Involuntary resettlement of diverse and dispersed rural communities to homogenized living in collective settlements such as apartments [26–28].

(c) Most resettlers endure land loss, unemployment, insecure food systems, higher living costs, and debt [29–33]. These economic conditions drive some local residents to exploit (and damage) land, water, fish, and other natural resources [19, 34–36].

Emission reduction quotas have been distributed unevenly and unfairly to provinces and cities [37]. Many cities, like Beijing, Suzhou, and Guangzhou, have been listed as 'pioneer cities' that aim to peak their carbon emissions by 2020 [38, 39]. All these cities experienced electricity outrages and coal-fired power plants shutdown in December 2020, and more recently in September 2021 [12, 40]. Many people working in office buildings have to use the stairs to reach offices on the 20th floor. Some office managers can only turn on air conditioners and heaters if the room temperature is less than 3 °C [40].

Exacerbation of water scarcity due to reduced river inflows and groundwater recharge [41]. In the Loess Plateau, many introduced trees are not native, transpire more water, and arid areas increased by 1.6 million square kilometers since 1980 [42]. Downstream communities have suffered exacerbated water shortages, as well as increased production costs and risks caused by water shortage [34].

(a) Rare earth mining, high water usage, dust emissions caused by vegetation removal [43], exposure to hazardous chemicals and habitat fragmentation [44].

(b) Solar expansion has resulted in land loss via illegal occupation of farmland [45], increased local corruption due to a lack of independent 30-party oversight, and accelerated land disputes by excluding local communities in decision-making [46–48].

(a) Some local residents say they are negatively impacted, including sleep disturbance and psychological distress, by noise from wind turbines [49] and find the windmills aesthetically displeasing [50].

(b) Noise and flicker generated by turbines (particularly poorly sited turbines) are dangerous to wildlife such as bats and birds from poorly sited turbines. Roughly 234,000 birds are killed annually from wind turbines in the USA alone [51]. Offshore wind plants may also negatively affect marine fauna [49].

(c) Large wind farms can affect local weather and climate [49], including an elevation of the bushfire risks caused by turbine malfunction, such as the operation of the wind farm near Palm Springs in Southern California [51, 52].

(Continued.)

Table 1. China's climate policies, their contribution to Paris Agreement NDC, and side-effects.

| Policy                        | Contribution to Paris Agreement NDC [1, 2] | Perverse outcomes                                                                 |
|-------------------------------|------------------------------------------|-----------------------------------------------------------------------------------|
| Hydropower expansion          | By 2030, lower than 65% CO₂ emission per unit of gross domestic production (GDP), and increase the share of non-fossil fuels in primary energy consumption to 25%. | (a) Excessive hydropower construction that leads to oversupply and curtailment [17, 18].
(b) Loss of aquatic biodiversity, fragmentation of habitats and impacts on downstream floodplains, wetlands, estuarine, adjacent marine ecosystems [17, 19], and fisheries [20–22].
(c) Forced resettlement that reduces quality of life, with one-third of those resettled living in severe poverty [23, 24]. |
| Ecological migration enables carbon sequestration through afforestation | Increase the share of forest stock volume by 6 billion cubic meters, compared to 2005. (b) Involuntary resettlement of diverse and dispersed rural communities to homogenized living in collective settlements such as apartments [26–28]. |
| Carbon dioxide quotas         | By 2030, lower than 65% CO₂ emission per unit of gross domestic production (GDP), and increase the share of non-fossil fuels in primary energy consumption to 25%. (c) Most resettlers endure land loss, unemployment, insecure food systems, higher living costs, and debt [29–33]. These economic conditions drive some local residents to exploit (and damage) land, water, fish, and other natural resources [19, 34–36]. |
| Desert afforestation          | Increase the share of forest stock by 6 billion cubic meters, compared with 2005. | Exacerbation of water scarcity due to reduced river inflows and groundwater recharge [41]. In the Loess Plateau, many introduced trees are not native, transpire more water, and arid areas increased by 1.6 million square kilometers since 1980 [42]. Downstream communities have suffered exacerbated water shortages, as well as increased production costs and risks caused by water shortage [34]. |
| Solar expansion               | The installed capacity of solar and wind power will be over 12 billion kilowatts by 2030. (a) Rare earth mining, high water usage, dust emissions caused by vegetation removal [43], exposure to hazardous chemicals and habitat fragmentation [44]. |
| Wind expansion                | The installed capacity of solar and wind power will be over 12 billion kilowatts by 2030. (b) Solar expansion has resulted in land loss via illegal occupation of farmland [45], increased local corruption due to a lack of independent 30-party oversight, and accelerated land disputes by excluding local communities in decision-making [46–48].
(c) Large wind farms can affect local weather and climate [49], including an elevation of the bushfire risks caused by turbine malfunction, such as the operation of the wind farm near Palm Springs in Southern California [51, 52]. |
example, increased investment in concrete and steel after COVID-19 [10] may not mean China’s low-carbon transition is compromised. This could instead represent acceleration. Concrete and steel can be used in the construction of hydropower dams, wind turbines, solar farms and supporting infrastructure, such as roads and bridges [17].

Intersectional climate policy analysis, highlighting dimensions of social costs and social justice, is needed to accurately capture the outcomes and impacts of China’s climate actions. The trade-offs, risks and benefits must be considered explicitly, both in external policy analysis and internal policy decisions. In particular, understanding political motives [59] may be needed to judge China’s climate mitigation performance, especially by looking at how its power affects domestic and global communities [60].

4. Motives behind ambition: projecting soft power in global governance

Side-effects of climate mitigation actions have been often downplayed or ignored due to the focus on reducing carbon emissions [61–63]. Even less impactful climate actions have had high social costs, especially on indigenous communities’ livelihoods and culture [61, 62]. Why does China still promote such actions despite past experiences and current problems (table 1) [12, 64]? Cross-scale intersectional climate policy analysis can help to identify some hints on China’s climate choice by connecting China’s climate performance to its larger-scale political ambitions, such as geopolitical influences [65].

China’s climate mitigation choices are primarily a matter of political and industrial strategy, not altruistic climate mitigation [12, 66, 67]. China’s climate leadership is driven by the aspirations of positive international influence as a ‘responsible’ country. International cooperation on climate governance is increasingly important for global governance [68]. China, as the world’s largest emitter of CO₂, aims to project more soft power through its leading commitment to climate change, especially by comparing with some ‘slow’ Western countries, such as Australia [69, 70]. Climate mitigation has been prioritized in its development and diplomacy strategies [71–73], even sometimes given priority over the COVID-19 vaccine [74]. China’s spokesperson Hua Chunying has emphasized that climate cooperation between US and China is a critical political priority [74].

China’s climate ambition is not only affecting domestic citizens’ livelihoods and interests [14, 17, 31], but also communities in other countries [75, 76]. Although 80% of China’s overseas energy investment are in fossil fuels as of 2018, it faces increased global pressure to close fossil fuel facilities, as well as respond to public pressure when locals feel they do not benefit enough or encounter environmental issues triggered by these Chinese investment projects [77, 78]. Consequently, China’s policies increasingly encourage environmentally and socially responsible overseas energy investment [78, 79]. For example, Chinese Belt and Road investments in renewable energy infrastructure in developing countries will be over 1 trillion US dollars (USD) by 2030 [80, 81]. Chinese entities invested over USD 216 billion in overseas power plants from 2000 to 2017. USD 40.5 B is directly invested in renewable electric power, including hydropower (USD 23.1 B), nuclear (USD 6.7 B), solar (USD 5.5 B), and wind (USD 5.2 B) [81]. Moreover, in the first half of 2021, there were no Belt and Road investments into coal for the first time, despite plans to restrict coal investments from 2013 [82].

These overseas investments align with the Paris Agreement but still have high impacts on local communities. For example, China’s hydropower expansion on the upper Mekong River and investment in dams in the lower Mekong basin has negatively impacted downstream ecosystem and community livelihoods [83–85]. Despite committing to no new funding for coal fired power stations in September

### Table 1. (Continued.)

| Policy            | Contribution to Paris Agreement NDC [1, 2]                                                                 | Perverse outcomes                                                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Nuclear expansion| By 2030, lower more than 65% CO₂ emission per unit of gross domestic production (GDP), and increase the share of non-fossil fuels in primary energy consumption to 25%. | China’s nuclear power generating capacity increased 29 GW (capacity in 2019 is 2.7 times higher than 2010) in the past ten years. China motivated to deploy nuclear power due to increasing electricity demand and environmental concerns [53]. Furthermore, the scalability of solar and wind power, i.e. 34%–73% of total energy generation by 2050, in China depending largely on the expansion of nuclear power [54]. However, severe accidents and waste treatment are large risks [55, 56]. As nuclear technologies are a mixture from many countries, making consistent safety standards is hard to achieve [53]. The possible leak from the Taishan Nuclear Power Plant in Guangdong Province in June 2021 is a good example [57]. |
2021 [86]. China’s green Belt and Road investments have also been characterized as ‘greenwashing’ [87], especially in lower-income countries and regions. Low-carbon investments were mostly concentrated in higher-income countries and regions while lower-income countries and regions have not benefitted from a shift away from traditional infrastructure projects [87], negative impacts (e.g. pollution and neocolonialism), and risks for local communities [88]. China’s other green investments are also critical instruments of diplomacy and influence on host countries’ local governance [76, 80, 89], representing China’s green mercantilism that aims to build coalition on climate change and sustainable development policies [90], and lead the world to green and zero-carbon futures [91].

In summary, China projects soft power and cultivates an image of a responsible international citizen by actively participating in international climate institutions. However, such participation triggers new impacts on host communities that are mostly overlooked.

5. Policy implications

While China’s climate policies have a number of side-effects, they are not necessarily undesirable. Moreover, China’s ‘forward-looking’ climate actions can provide lessons for others on managing adverse side-effects and trade-offs of climate actions. All climate actions we discussed previously are effective instruments of emissions reduction, and are therefore worthwhile supporting if negative impacts are reduced.

Adverse side-effects do not have to be a consequence of emissions reduction [6]. Policy amendments can reduce adverse outcomes and unlock positive social impacts [92]. Ensuring positive social outcomes can reduce social resistance, aid scalability and long-term policy resilience, and are an opportunity to demonstrate climate leadership [93]. Not doing so risks repeating the mistakes and inequality that has hindered climate policy in the past [61, 62]. To achieve a just transition, we outline five policy approaches that should be integrated into current and future decision-making, especially for countries and regions that take big and rapid steps towards climate change mitigation.

Approach 1: Explore more bottom-up policy, finance, and decision-making approaches, like community microgrids that are reviving some Chinese rural areas [94], that can complement top-down interventions [95]. Strategies and policies should be consistent with local circumstances, meet local development objectives and needs, and adapt to local political priorities [96].

Approach 2: Restrict local malpractice in climate governance by ensuring accountability [97] and invest in engagement and integration of a wide range of community-level stakeholders to identify just and adaptive pathways [98].

Approach 3: Invest in robust and transparent assessment, monitoring and evaluation of environmental and social impacts of proposed emissions reduction policies [12, 98].

Approach 4: Provide retraining or adequate compensation packages and ongoing supports, such as redistributing profits from green projects, for people who are negatively impacted by emissions reduction policy [99].

Approach 5: Involve more international organizations in climate governance [100] and respect host communities’ rights and views on investments [80].

These approaches should not be considered nor implemented in isolation. For example, bottom-up engagement (Approaches 1 and 2) can help inform effective implementation of retraining or compensation for impacted peoples (Approach 4). Similarly, involving international participants (Approach 5) can contribute to better engage local communities (Approach 2) and provide more robust assessment of prospective impacts.

6. Conclusion

Policy driven by a single overriding metric, in this case, emissions reductions, generates adverse side-effects. Policymakers and analysts must look beyond emissions reductions to identify solutions that generate multiple benefits. Understanding, and addressing adverse side-effects of well-intentioned policy is critical to just, low-carbon transitions and sustainable development. Unacceptable social trade-offs plagued the implementation of the Kyoto Protocol [61] and persist today [101]. In order to ensure the success of the Paris Agreement and current climate policy, processes should be adopted to maximize benefits, minimize costs, identify potential conflicts, and understand the trade-offs of climate policies. Actions now can determine whether history will see ‘The Chinese Century’ [73] as an achievement of modern civilization, or a monument to inequality.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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Conflicts of interest

The authors declare no conflict of interest.

ORCID iD

Hongzhang Xu  https://orcid.org/0000-0001-8904-2976

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