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Commentary

Are China's Nationally Determined Contributions (NDCs) so bad?

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A recent article by Robiou du Pont and Meinshausen [1] (hereafter RM2018) declared that when taken as benchmark by other countries, the Nationally Determined Contributions (NDCs) of India, the EU, the USA and China lead to 2.6, 3.2, 4 and over 5.1 °C warmings. RM2018 was quickly referred in media that China's NDC is "one of the worst to contribute to the global effort to reach the targets under Paris Agreement".

The purpose of RM2018 is to analyze the warming effects of the bottom-up Paris Agreement emissions pledges. The authors of RM2018 expect the results of their study could inform on the adequacy of the emissions targets contained in current NDCs with the Paris Agreement.

The results of RM2018 are surprising as they are quite different from our understanding. Their conclusion is biased and will not help the international collaboration on climate change.

However it is understandable for author's this results, if looking at authors previous published paper [2], and got comments from 17 experts to criticize the paper "Cascading biases against poorer countries" [3]. They pointed that authors used "the methodology reflects a selection of approaches that are biased in favor of wealthier, higher emitting countries in three ways".

RM2018 reflects a continuous philosophy of author's research ideas, with similar finding from author's previous paper. Table 1 shows the benchmark allocation targets by China and "comparable" 2030 GHG emissions allocations by other countries or regions depending on the chosen allocation approach by other countries, used by RM2018 for the calculation. It shows if China's CO_2 emission increase 35% from 2010 to 2030 by following China's NDC, comparably, there will be 13%, 107%, 19%, 42% and 30% increase for Japan, Norway, US, Switzerland and EU, and 45%, 51%, 115% increase for Saudi Arabia, Argentina, India, respectively. This table provides the source of 5.1 °C warming.

Findings from this paper are helpful for policy makers and researchers to understand the position of countries NDC in mitigating global warming impact. It is good that authors want to contribute the policy making process for ratchet-up of NDCs in future. However, inadequate research method and florid could often lead to opposite way, based on our experience to be involved in the policy making process. Here are some points we want to bring for discussion.

First, the definition of China's NDC in RM2018 has fundamental flaws. What is China's NDC? China's NDC could be summarized as: to achieve the peaking of carbon dioxide emissions around 2030 and making best efforts to peak early; to lower carbon dioxide emissions per unit of GDP by 60%–65% from the 2005 level; to increase the share of non-fossil fuels in primary energy consumption to around 20%; and to increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.

Therefore, to analyze the effects of NDC, we need to include all aspects of the components, because they are interlinked with each other, to form NDC as whole. In the meantime, even for the target, there are two ways, one is to achieve peaking of CO_2 emission around 2030, the other one is to make efforts to peak early. Analyzing peaking around 2030 as only part of NDC in China could not describe the effort proposed by China. Based on our experience to be involved in the discussion to prepare China's NDC, both peaking around 2030 and making effort to peak early have same weight to express China's effort in the commitment for UNFCCC (United Nations Framework Convention on Climate Change). This is not only a fundamental flaw for this paper, but also for many other studies that assess China's NDC, by only picking up "peaking around 2030" without considering the possibility of an early peak.

Second, the assumption of China "to make 35% CO_2 emission increase by 2030 from 2010" in RM2018 is not convincing. In the statement of Chinese NDC, peaking around 2030 is only a description of the curvature of the emission trajectory, without specified emission levels by 2030. The reason for China to propose commitment in such a way is there is much lack of sufficient studies on future emission scenarios. It is very difficult to propose a certain level of CO_2 emissions by 2030, even though there was intention to do so by many people involved in the decision making process. The emission level in 2030 from RM2018 is one way to assess the role of China's NDC, but their assumptions have large uncertainties given the rapid changing social economy activities in China.

Then come back to the question, what is the future emission by 2030? In the paper, author assumed there would be 35% increase of

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Table 1
Benchmark allocation targets by China and "comparable" 2030 Greenhouse Gas emissions allocations by other countries or regions, used by RM2018 for the calculation.[a)]

	Countries, regions, and bunkers	Rule that Greenhouse Gas emissions allocation follows		
		The less ambitious of ECPC50 and CDC (%)	ECPC50 (%)	CDC (%)
Countries	Argentina	51	20	51
	Australia	25	−15	25
	Brazil	34	−2	34
	Canada	16	−25	16
	China[b)]	35	35	35
	India	115	107	115
	Indonesia	20	−1	20
	Japan	13	−11	13
	South Korea	−4	−18	−4
	Mexico	40	28	40
	Norway	107	41	107
	Russian Federation	11	−30	11
	Saudi Arabia	45	10	45
	South Africa	35	3	35
	Switzerland	42	20	42
	Turkey	25	17	25
	USA	19	−25	19
	EU28	30	−5	30
Regions	Other East Asia	−25	−40	−25
	Middle East & North Africa	56	41	56
	Other South-East Asia & Pacific	3	−9	3
	Other Pacific OECD	50	−10	50
	Other South Asia	−45	−45	−45
	SubSaharan Africa	22	−9	22
	Other Western Europe	29	−26	29
	Other Economies in Transition	38	18	38
	Other Latin America	38	12	38
Bunkers	Intl. Aviation	90	90	90
	Intl. Maritime	75	75	75
	World	33	12	33

[a)] These benchmark allocation targets depend on the chosen allocation approach by other countries [1]; [b)] China's announcement of peaking its CO_2 emissions by 2030 is illustratively quantified by a 35% increase of GHG emissions (see first three columns).

CO_2 emission in China from 2010 to 2030, by picking up from related studies. By 2016, China's CO_2 emission increased by 16.5% relative to 2010. With consideration of China's New Normal economy pattern after 2014, and low carbon technology progress, it is very difficult for China to make 35% CO_2 emission increase by 2030 from 2010. This just presents the uncertainty to figure out the future emission in China by 2030. If emission in 2030 is lower, then the conclusion will be largely changed. This could bring some observation that the CO_2 emission level for China by 2030 used in this paper is just one possibility, hence it is unconvincing to conclude that "the NDC of China appears very unambitious".

In RM2018 there is also discussion about the CO_2 emission from China by 2030 (Fig. S1 online) being −34% compared with that in 2010 to keep 2 °C global warming target. So far there is no such a kind of research results from national teams of China. This brings the question how to use the results from this paper based on their equity discussion. There are some results from IAMs on China's emission scenario, but normally use relative simple method such as carbon tax, which is hard to implement in the policy making process.

In the meantime, the conclusion from RM2018 will not help much on the international collaboration process. The policy making to support Paris Agreement targets is getting more and more willing-to-do process, even though discussion about equity is still important. Understanding the warming and its impact are bringing parties of UNFCCC moving toward to making strong actions [4–6]. Based on the recommendation from IPCC [6,7], feasibility analysis is getting to be crucial in coming process for ratchet-up of NDCs in future. Discussion about equity could be much more used in the way to encourage collaboration such as financing support, rather than burden sharing regime, which was not proven successful before. As a top emitter in the world, China shares the responsibility for GHG emission reduction, provided commitments to UNFCCC.

And for China, setting a clear long-term targets is challenging. Chinese policy making is more focused on 5 years plan, with 10–15 years plans regarded as long-term plan. A recent published report by Climate Transparency gives a medium score for China's climate change policy performance [8]. The low score in the assessment is given due to muted 2050 targets for China for Paris Agreement. For current policies, there are high score for China. This brings the question how to assess China's NDC and related policy implementation. Based on our analysis, China's current policies on renewable energy, nuclear, electric car, phasing out coal use, are the strongest in history, though possible to dwindle in the future.

Actually, in order to support China's NDC, policies adopted in China could be one of the best in the world, even though many policies are not specified for climate change mitigation. In 2013, national action plan on air pollution control was released by State Council [9]. After that, all provinces made their own action plan with detail measures. Most important option in the national action plan and provincial action plan is to control coal use, and promote clean energy use including natural gas, renewable energy and nuclear. The process to control air quality was moving strictly, and driven by these policies, coal consumption peaked in 2013 in physical unit and in 2014 based on standard coal equivalent, and then continues to decline. There are 4.7% reduction in 2015, and 3.7% in 2016 relative to the former year. In 2017, there is 0.4% increase which is 7.5 million ton coal [10].

With the increase in use of natural gas and petroleum products substituting coal, CO_2 emission reduced after 2014. Based on the energy use data in 2016, there are around 450 million ton CO_2 emission reduced, accounting for 5% of total CO_2 emission from

energy activities. Despite a small increase of CO_2 emission from clinker manufacture, the total reduction of CO_2 emission is 430 million ton.

In the last two years, there is substantial increase in newly installed capacity on wind power, solar power, and hydro to be more than 120 GW, together with 11 GW newly installed capacity for nuclear. It dominated global newly installed capacity for low carbon power, with more than 40% of global newly installed capacity in last two years. In 2016 and 2017, newly installed solar PV power generation in China accounts for 53% of global newly installed capacity [11].

Due to industrial structure change, energy demand increase will be quite slow, energy demand by 2020 will be much lower than the government planning. Based on scenario analysis, future newly increased energy demand could be supplied by renewable energy, nuclear, and natural gas. Coal decline will continue. It is less likely that coal use will bounce back in China. Therefore the trend of CO_2 emission in China already changed from a rapid increase between 2000 and 2012, to flattening out post 2013. Based on modeling results from authors, CO_2 emission would much likely to peak before 2022 [12].

In China there are already multiple national strategies set up for energy transition, GHG mitigation and air pollutant reduction. Energy transition was proposed in 12th Five Year Plan [9], and again strongly pushed by "Energy Revolution" announced by President Xi Jinping in 2014. In Paris Agreement, there are targets set-ups for 2100 to be well below 2 °C, with ambitious target on 1.5 °C. China has signed the agreement, and will support the global target. In the meantime, large scale actions were initiated in 2013 by the national action plan on air pollution control for the period from 2013 to 2017. None of these strategies has clear long-term target.

With the publication of IPCC Special Report on 1.5 °C Warming [7], the discussion about the possible pathways is getting to be in air. However, when the 1.5 °C target was discussed among stakeholders on climate change, including policymakers, negotiators, researchers, NGOs, a common response is it is impossible. Even for 2 °C target, there is a long time argument for it feasibility. There is still not strong consensus on the feasibility of emission mitigation for the 2 °C target. Now the 1.5 °C target was proposed and there are much more doubt about the practical implementation of mitigation pathways for it. Many people thought this is just for negotiation to show "Ambitious".

Now the road is ahead of us and we need to make choice where to go, what kind of way we can work together. Technology progress and willing-to-do could bring us together.

Conflict of interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.scib.2019.01.005.

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