Tohoku University Research Unit for Building a Management Scheme
for the Atmospheric Environment of Northeast Asia ***Working paper 2015-2***

Assessment of China's GHG emission reduction target for 2030

To peak CO_2 emission in 2013 instead of 2030 !?

May 12, 2015
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1. Introduction

On November 12, 2014, the Chinese Government pledged that "China intends to achieve the peaking of CO_2 emissions around 2030 and to make best efforts to peak early" in its joint statement of US-China summit. It is highly likely that this will be the main point of China's Intended Nationally Determined Commitments (INDCs). Several research institutes have already conducted the assessment of this China's "to peak CO_2 emission by 2030" target and have concluded that "to peak in 2030 will not be sufficient to conform to 2 degrees Celsius target, which is the target to limit the global temperature rise within 2 degrees Celsius since industrial revolution" (e.g. Climate Action Tracker, 2014).

Counterarguments to such conclusions are expected on the basis of the advancement in various measures to promote energy conservation and low-carbon energies, intensity improvement, and the way to share GHG emission reduction efforts. Furthermore, China's peak in coal consumption may come earlier than expected, thereby advancing the peak of CO_2 emission to come before 2030. In fact, the calculation based on the most recent data from the Chinese Government released on February 26, 2015 （National Bureau of Statistics of China, 2015）, indicates that China's coal consumption and CO_2 emission (from fossil fuels) have actually decreased in 2014.

In consideration of the above situation, this paper discusses China's GHG emission reduction target with focuses on the conformity with 2 degrees Celsius target, anticipated counterarguments, and possibility of moving up the targets. For this, Section 2 introduces actual assessment made by several research institutes in the world. Section 3 reviews possible counterarguments to such assessment results. Section 4 discusses the most recent arguments and current situation of the peak year of coal consumption and CO_2 emission in China. Finally, Section 5 summarizes the paper.

2. Assessment by research institutes

The Climate Action Tracker, which is the association of research institutes to review the GHG emission reduction targets of various countries, has assessed China's target to peak CO_2 emission by 2030 announced by the Chinese Government, and has concluded that "to peak in 2030 is not sufficient for 2 degrees C target." (Climate Action Tracker 2014) Their reasons include: 1) GHG emission trajectory estimated on the basis of peaking CO_2 emission in 2030 is placed above the GHG emission trajectory of "Benchmark 450 scenario" in LIMITS Project, which is an international project to compare multiple number of models (LIMITS, 2013); and 2) the resultant GHG emission reduction is less than those achievable with the introduction of the best available technologies (BATs). Moreover, the analysis of Höhne et al (2014) which has reviewed more than 40 studies and specified the GHG emission reduction targets of 10 regions under various effort-sharing methods, implies that the China's emission in 2030 need to be almost equal to its emission in 2010 under several effort-sharing methods such as "equal per capita emission". In addition, the staff working paper of EU Commission (Commission of the European Union, 2015) to justify EU's 2030 target (40% reduction from year 1990) suggests that what EU Commission considered the "fair and ambitious GHG emission reduction target of China" should be "to peak GHG emission around year 2023."

3. Anticipated counterarguments

Against such assessments and criticisms from the international society, some may develop the following counterarguments.

First, some will likely point out China's progress in the enforcement of concrete policies and measures. For example, China has drastically increased its investment in renewable energies in recent years. According to Renewable Energy Policy Network for the 21st Century (2014), in the year 2013, China has become the world's largest investor in renewable energies, with 21% share in terms of global investment amounts. China invested more in renewable energy than all of Europe did in 2013. In the same year, China has introduced 12 GW solar energy facilities, which is 50% greater than any one nation's single year investment in the past. For wind power, China is the number one country in the world since 2009, in terms of its accumulated wind power capacities. In the aspect of institutions, China has already introduced, though in a pilot phase, GHG emission trading systems in seven of its cities/regions, with the scale second to EU's Emission Trading Scheme (EU ETS). Their energy taxation system has been reformed in a way to promote energy conservation.

Second counterargument can be based on the international comparison of intensity improvements. To peak GHG emission by 2030, China assumes 4.5 % per year reduction in its energy consumption per GDP (Tsinghua University Energy Economy Environment Research Institute, 2014)[1]. No developed

[1] Assumption of the GDP growth rate is 4 to 5 %/year, and energy consumption growth of 1.5 to 2%/year. China's GDP intensity was reduced by 4.8% from the previous year in 2014 (National Bureau of Statistics of China (2015).

countries had ever reduced energy intensities at such rate during their economic development stages. (Many developed countries had the economic growth rate of around 3% per year at their peak of GHG emission.) Actually, China did reduce their energy intensity by 19.1% during the period of 2006 to 2010, which was much higher than those of any other emerging countries.

Thirdly, some may criticize the "un-equitable" methodologies of GHG emission reduction efforts sharing used in the models referenced by the Climate Action Tracker (2014) and the EU Commission. As the calculated values of such models are based on the methodology to calculate GHG emission reduction effort sharing under the concept of "equal marginal abatement cost" to minimize the global cost of GHG emission reduction cost-effectively, it will be disadvantageous to emerging countries like China with less historical emission. It is also important to know that "marginal abatement cost curve" to be used for calculating cost differ widely from model to model due to different assumptions on technology, cost, discount rates, etc. (Hanaoka and Kainuma, 2012).

Whether above counterarguments have sufficient persuasive power or not, the views will differ. For the first counterargument, China's introduction of various measures is easy to understand, but, when asked whether these measures are sufficient enough or not, many will likely answer that they are not (whatever their own emission reduction efforts are). For the second counterargument, certainly there has been no other country in the history of the world that has realized the scale of intensity reductions China has done. Still, the history is a thing of the past and, in consideration of the new global challenge to achieve 2 degrees Celsius target, the international community may find difficulty in accepting the China's claim that their global warming measures of today will be wholly sufficient. For the third counterargument, the author consider it having a certain degree of persuasiveness, in consideration of the descriptions of equity in GHG emission reduction effort sharing stated in IPCC's Fifth Assessment Report, as well as Höhne et al. (2014). However, it is necessary to note that the other methods of effort sharing (for example, equalizing per capita emission) in the same Höhne et al. (2014), and Jiang et al. (2014)[2] have also indicated the need to peak emission before 2025 in China, in order to achieve global 2 degrees Celsius target. In other words, the assessment of China's GHG emission reduction targets largely depends on how strongly historical responsibility is considered as the indices of equity.

4. Peaking in 2013 !?

4.1. Coal consumption peak and CO_2 emission peak

In the case of China, today's focus would be whether CO_2 emission can peak "before" 2030, rather than "in" 2030. According to aforementioned latest "Statistical Communiqué of the People's Republic of China on the 2013 National Economic and Social Development" [3] (National Bureau of Statistics of

[2] Jiang et al. (2014) used "equal per capita emission" as the methodology to share GHG emission reduction efforts.

[3] "Statistical Communiqué of the People's Republic of China on the National Economic and Social Development" is an annual bulletin to be published at the end of February every year.

China, 2015), it is actually possible to calculate that CO_2 emission (from fossil fuels) has "peaked" in 2013. Though noted as provisional data, this bulletin describes the actual data of year 2014 for energy consumption, coal consumption, natural gas consumption, crude oil consumption, electric power consumption, shares of coals and renewables in final energy consumption, and others in comparison to those of year 2013. For example, coal consumption in 2014 was 2.9% less than that in 2013. When calculated based on these data, the CO_2 emission (from fossil fuels) has peaked in 2013, or at least has decreased in 2014 (Fig. 1). [4]

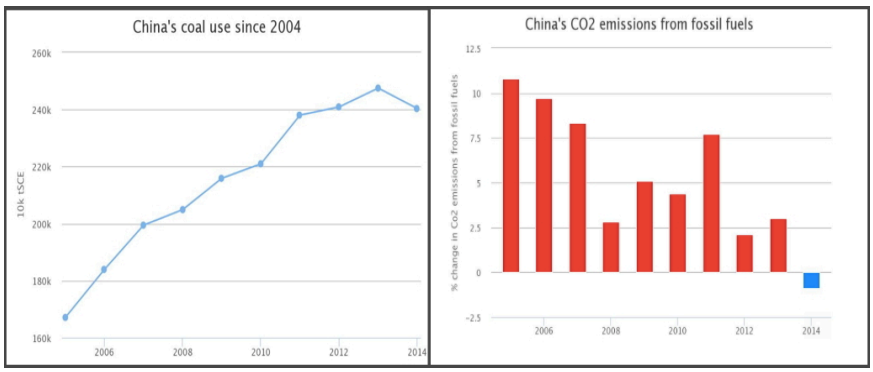

Fig. 1. Changes in China's coal consumptions and CO_2 emission (from fossil fuels) based on National Bureau of Statistics of China (2015)

Reference: Clean Technica, March 13th, 2015

http://cleantechnica.com/2015/03/13/china-coal-consumption-co2-emission-drop-2014/

(Accessed May 10, 2015)

The main reasons for coal consumption decrease can be attributed to the effects of various governmental measures implemented as air pollution mitigation actions and the measures to change industrial structures. Economic downturn can also be one of the reasons. More specifically, those measures include: 1) tightened regulation of coals and promotion of energy conservation; 2) reforms of taxation systems and protection measures; and 3) increases in renewable and nuclear power generation. The actual contributions of these factors will be analyzed in the future.

[4] Based on the National Bureau of Statistics of China (2015) released on February 26, 2015, Glen Peters at CICERO (Center for International Climate and Environment Research) in Norway quickly calculated that total CO_2 emissions from fossil fuels and cement production in China has decreased by 0.7% in 2014 from 2013. （https://twitter.com/Peters_Glen/status/570929352831066112/photo/1）

4.2. Adjustment of the energy consumption and coal consumption data

In fact, there is an another noteworthy fact in National Bureau of Statistics of China (2015). That is the upward adjustment (modification) of data for energy consumption and coal consumption in 2013 (Table 1).

Table 1. Energy consumption, coal consumption and share of coals (before and after adjustment)

	2014	2013 (after adjustment)	2013 (before adjustment)	Difference (%)
Energy consumption (Mtce)	4260	4168	3750	11.1
Coal consumption (Mt)	3940	4054	3465	17.1
Share of coals (%)	66.0	69.5	66.0	-

Reference: National Bureau of Statistics of China (2015) and National Bureau of Statistics of China (2014)

As long as the author knows, some researchers were already aware of the possibility of the Chinese Government making upward adjustment of its energy consumption and coal consumption data before the publication of National Bureau of Statistics of China (2015) on Feb.26, 2015. It is also well known that China's National Bureau of Statistics did modify their data of coal consumption in the past. For example, the drastic reduction in coal consumption reported for the period of 1998 to 2002 was later modified due to the correction to raise the number of coal consumption. The reason for such correction at that time was said to be the error in the statistics of small coal mine. Even in more recent statistics, researchers indicated some discrepancies between the total coal consumption of the nation and the sum of sectoral coal consumptions in China. (Horii, 2015)

This time, the direct cause or background of upward adjustment in energy consumption and coal consumption can be statistical "under-reporting" of local governments and enterprises, in response to the central government's tightening of regulations for air pollution and energy conservation measures.[5] Until more detailed analysis is done, however, no clear-cut conclusion can be drawn. Still, it is fairly certain that statistics of coals has some problems.

From the historical viewpoint, however, the Chinese Government has gradually improved the accuracy of statistical data to some extents, as they develop and establish various systems of relevancy. Moreover, it is also true that they now have better capacity to verify the accuracy and reliability of statistical data

[5] In China, a veto by one vote system has been implemented, in which the achievement of environmental and energy conservation targets becomes the key indices in evaluating the performances of local government officials. Therefore, these officials feel strong pressures to meet such targets. In 2010, the heating energy supply was forcibly stopped in some places to meet energy conservation targets under the 11th Five-Year plan (for 2006 to 2010), causing serious problems in the society.

through multiple methods.

As for the future development, the Chinese Government is likely to continue further its industrial re-structuring, and the enforcement of more strict air pollution measures, while unlikely maintaining rapid economic expansion. Their power generation capability in renewable and nuclear has actually increased. Most recently (March 21, 2015), the Shen Hua Group, a major coal supplier in China, published their forecast that "coal sales in 2015 will decrease by 10% from 2014".[6] Moreover, according to the Reuters, in 2014, utilization rates at China's thermal power generators fell to a lowest-ever 53.7 percent, down from 57.3 percent in 2013 and resulting in coal for power use dropping 1.3 percent compared with 2013. In addition, utilization rates at thermal power plants - nearly all coal-fired - have dropped to 52.2 percent in the first two months of 2015, Reuters calculations based on monthly power generation and consumption figures show. If that rate holds for the full year, it would be a new annual low[7].

There are two important factors to be addressed regarding future coal consumption. First factor is how coal-to-gas and coal-to-oil projects will develop in the future since these projects are the biggest source of additional coal demand outside the power sectors (Myllyvirta, 2014). However, the economic environment to invest on these projects is not so favorable currently and massive water supply required in these projects may cause another environmental problem in water-scarce China. Second factor is the possibility of Chinese Government introducing measures to stimulate the economy if very serious economic downturn continues, which may result in the increase of the coal consumption.

Therefore, although some uncertainty remain, coal consumption is not likely to increase significantly but rather decrease in the near future, making it necessary to consider the problem of upward adjustment in the statistical data of 2013 or before, separate from the trend of coal consumption decrease in 2014 and afterward.

As shown in Table 2 below, recent studies and reports published from several international research institutes and market analysts indicate that China's peak of coal consumption will come unexpectedly earlier. Moreover, many researches listed in Table 2 assume some time laps of two to 10 years between the peak of coal consumption and that of CO_2 emission.[8]

In other words, whether China's coal consumption really hit the peak in 2013 or not, it is possible that China's coal consumption peak before year 2020, if the current domestic and international situation in politics and economy continues, according to the projections made by many researchers and market analysts. With due consideration to a time lag in peaking time, it means that CO_2 emission will likely peak well before 2030.

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[6] http://reneweconomy.com.au/2015/more-signs-of-peak-coal-as-chinas-shenhua-forecasts-10-sales-decline-35119

[7] http://www.reuters.com/article/2015/03/26/china-coal-idUSL3N0WL32720150326

[8] For the coal consumption peaking issues, including the trends of Chinese energy policies, refer to Li (2014), Shuo and Myllyvirta (2014), Myllayvirta (2014) and Myllayvirta (2015).

Table 2. Assumed peaks of coal consumptions and CO_2 emission of China in various studies

Study names	Scenario names	Peak year of coal consumption	Peak year of CO_2 emission	Notes
Zhou et al. (2011)	Continued Improvement	2030	2032	Research group of Lawrence Berkeley National Laboratory of US
	Accelerated Improvement	2019	2027	
IEA WEO (2013)	New Policies	2025 (flattening)	NA	
Citi Research (2013)	Transition	2017	NA	Market analysis by a private company in the US
	Deep Transition	2015	NA	
IEA WEO (2014)	Current Policy	After 2040	After 2040	New Policies scenario considers the effect of $PM_{2.5}$ measures to some extent
	New Policies	2030	2030	
	450 ppm	2020	2018	
Chinese Academy of Engineering (2011)		2030 (peaking)	NA	
Tsinghua University Energy Environment Economy Research Institute (2014)	Continued Effort	2035	2040	A part of global Climate New Economy Project
	Accelerated Effort	2020	2030	
Bernstein Research (2014)		2015	NA	Market analysis by a private company in the US
Deutsche Bank (2014)		2016	NA	Market analysis by a private company in Germany
China National Coal Association (2014)		2020	NA	Association of the companies in the industry
Li (2014)		2015-2019	2025-2030	Research by a professor at Nagaoka University of Technology in Japan
Zhang et al. (2014)	No Policy	After 2050	After 2050	Joint research work between researchers of MIT and of Tsinghua University in China
	Continued Effort	2030	2040	
	Accelerated Effort	2020	2030	
Jiang et al. (2014)	Baseline	NA	2040	Research using the integrated assessment model by researchers at Energy Research Institute under the National Development and Reform Commission in China
	Low Carbon	NA	203（flattening）	
	Enhanced Low Carbon	2020 (peaking)	2030	
	2 degree	NA	2020	
Yang (2014)	Energy Conservation	2030	NA	Result of China Coal Consumption Cap Project, a joint research project between NRDC (US's research institute) and several Chinese researchers
	Coal-Control	2020 (flattening)	NA	
	2 degrees	2020 (peaking)	NA	

Note: "Peaking" means decrease starts.　"Flattening" means increase stops.

In terms of the CO_2 emission, the Chinese Government may revise conversion rate to calculate CO_2 emission from fossil fuel combustion due to change of the contents of the fuels, which may result in increasing the CO_2 emission. It seems that the Chinese Government is considering all issues mentioned above and is going to make the INDCs public in June, which will clarify many of these issues.

The joint statement of the US and China did refer to the 2 degrees Celsius target, while describing that the current target is not fixed. If the peaking of coal consumption before 2020 becomes quite apparent, or the peak in 2013 is ascertained to some extents, it is possible that the Chinese Government may advance the peak year of GHG emission reduction earlier at some point.

5. Conclusions

To assess China's GHG emission reduction target for 2030 may influence the assessment of other countries' GHG emission reduction targets. This is because there may be some countries that would try to justify their targets "in comparison to China." In this respect, also, the assessment of China's GHG emission reduction target for 2030 has special significance.

Now, if we are to consider 2 degrees Celsius target, and do not place much emphasis on historical responsibilities, then not many research institutes will evaluate China's GHG emission reduction target "to peak in 2030" as "fair and ambitious" target. Undoubtedly, some will try to make various counterarguments against such assessments, but the author is skeptical of some of their persuasiveness. Depending on how much importance being placed on historical responsibilities, the assessment of China's targets can be varied widely.

In addition, China has upwardly adjusted its statistical data of energy and coals as discussed in the latter half of this paper which made many researchers troubled to find appropriate interpretation of such adjustment as well as CO_2 emission peak. As long as the author knows, many of those involved in China's energy and climate change policy issues are already aware of the upward adjustment of statistical data with the decrease in coal consumption and possible CO_2 peak. Because the peaking comes much earlier than assumed, and probably because of a tactical reason for international negotiation, not many officials and relevant researchers would claim that the decrease of CO_2 emission will continue as is. It seems that quite a few recognize the high possibility of coal consumption decrease, while taking "wait and see" attitude towards CO_2 emission decrease. As for the upward data adjustment issue, it seems many are also waiting for the revision of the previous years' data, i.e., data before 2013. However, these data adjustments simply make the international community more doubtful in the reliability of Chinese data, which may, in some degree, strengthen criticisms to China's GHG emission reduction commitment and its climate policy itself.

Still, several international research institutes as well as market analysts have indicated the possibility of China's coal consumption peaking much earlier than expected, since several years ago. There is little

doubt that China is experiencing many structural changes in its energy mix and industrial structures because of many reasons including air pollution mitigation. In this sense, the issue of upward adjustment of statistical data until 2013 and the declining trend of coal consumption in 2014 and later be discussed separately. And it seems more appropriate to assume that coal consumption and CO_2 emission are not likely to show significant increases in the future.

The shrinking of global carbon budget due to China's data adjustment is a "bad news", but it will be better and, probably, more appropriate to accept the possibilities of much earlier peaking in China's coal consumption and CO_2 emission as a "good news".

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