MEDWIN PUBLISHERS
Committed to create value for Researchers

Journal of Ecology & Natural Resources

# Policy Options to Achieve China's Energy & Climate Targets

**Weiling Z and Honber D***

School of Economics & Management, University of Chinese Academy of Sciences, China

**Policy Article**
Volume 1 Issue 1
**Received Date**: May 11, 2017
**Published Date:** May 25, 2017

***Corresponding author:** Honber Duan, School of Economics & Management, University of Chinese Academy of Sciences, Beijing 100190, China, E-mail: hbduan@ucas.ac.cn

## Abstract

In this work, we developed a model framework of energy-economy-environment integrated system to explicitly explore the impacts of policy options on China's achievement of energy and climate pledges in 2030. The results show that roles of carbon taxes and alternatives subsidies played on the attainment of China's committed energy and climate targets are significantly different; more specifically, the policy of carbon tax performs more remarkable on emissions peaking, while the deployment of non-fossil energy technologies is influenced more by the alternatives subsidy. As a consequence, the government should pay great attention on optimizing the policy options and coordinating the policy effects of both carbon taxes and subsidies, in order to reach both the energy and climate goals in 2030 simultaneously.

**Keywords:** Integrated modeling; Emission peaking; Non-fossil energy development; Optimal policy options

## Introduction

Before Paris agreement, China has proposed its intended nationally determined contributions (INDC) plan, in which it is committed to peak its $CO_2$ emissions in around 2030, and increases the proposition of non-fossil energy in total primary energy consumption (TPEC) to 20%. Actually, it remains more than 12 years ahead of the target time, and whether the energy and climate pledges could be achieved is still full of uncertainties, involving the uncertainties on economic growth, energy technology progress, as well as subjective policy options. To be specific, with stringent policy efforts, the probability to peak China's emissions in time will be largely increased, and the peaking year could even be advanced for several years [1,2] while if we negatively response to emission abatement, then the target will be rather difficult to reach correspondingly [3,4], in effect, even if we make some efforts, the carbon peaking point may still be much later than the committed time [5]. Hence, analyzing the probability of achieving China's INDC plan is actually discussing the options of optimal policies.

By employing the one-sector energy-economy-environmental (3E) integrated model, CE3METL, we attempt to investigate the discrepant effects of some specific policies, i.e., carbon taxes and subsidies, on the attainment of INDC targets, and explore the corresponding role of optimal policy combination. CE3METL is the Chinese version of E3METL, Energy-Economy-Environmental Model with Endogenous Technological change by employing Logistic curves, which has been well developed by Duan HB [6] in 2013, and features its policy-driven multi-logistic technological diffusion mechanism [6]. To implement this study, we need to consider the possible emission budget (emission cap) of China under the global 2-degree warming-limit threshold. Raupach, et al. [7] discuss the differences of emission space allocation among crucial principles, such as grandfathering, equality, as well as blended one of both. Actually, Raupach's [7] emission budget plan in terms of inertia fits in well with the estimation of Ding, et al. [8] based on this, we refer it as our emission cap.

Additionally, we assume that the emission constraints are mainly achieved by the endogenous carbon taxes levied on fossil fuels, and subsidies on alternatives are also taken into account as other policy options [6].

The optimal simulation reveals that revenues from carbon taxes largely overpass the subsidy expenditures, as shown in (Figure 1), and to successful peak China's carbon emissions in 2030, the ratio of cumulative carbon tax and subsidy should be greater than 4. On one hand, we strictly requires that the carbon tax revenue fully covers the subsidy costs to keep the integrated system balanced, which should tell part of this story. On the other hand, the high proportion of cumulative carbon tax to subsidy closely relates to the stringency of emission budget. Overall, the stricter the carbon tax policy over subsidy, the higher likeness of carbon peaking will gain. For example, to peak China's carbon emissions in around 2025, the ratio of cumulative carbon tax and subsidy should be greater than 5.5. As observed in (Figure 1), given a lower ratio, the 2030 carbon peaking target is also likely to attain, and with respect to the higher ratio, the main discrepancy lies in different peak values. In general, with the stringency of carbon tax policy, the corresponding emission peak tends to decline. For instance, we could successfully achieve the committed emission peak goal in 2030, with the ratio of cumulative carbon tax revenues and subsidy costs both at 4.5 and 5.4, while the peak value for the former is 10.3 $GtCO_2$, and the latter is less than 100 $GtCO_2$. Thus, when discussing the achievement of China's carbon peaking target, we should pay great attention on the policy optimization and options; also, emphasis is also needed to put on the specific peak values.

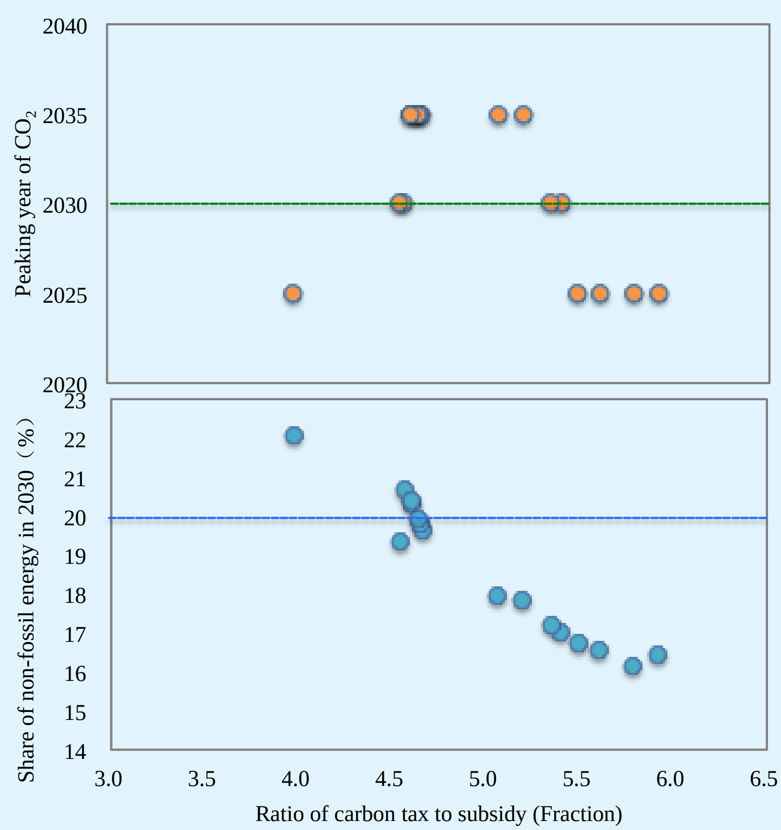


Figure 1: Impacts of policy optimum to attainment of energy and climate targets.

With respect to the significant influence of carbon tax policy on emissions control, the deployment of non-fossil energy technologies affects more by the alternative subsidies. This study reveals that the share of non-fossil energy in the TPEC will steadily grow, as the decreasing of proportion of carbon tax to subsidy. To be specific, given the proportion higher than 5.5, the share of non-fossil energy in 2030 is generally lower that 17%; if the proportion declines to 4.5, the corresponding non-fossil energy share may overpass 20%, i.e., the committed energy development goal could be reached. Moreover, keep the role of subsidy in the policy mix further enhanced and the proportion of carbon tax to subsidy lowers to less than 4, and then the share of non-fossil energy will be as high as 22% in 2030. As a consequence, we should sufficiently stress the discrepant policy effects of carbon tax and subsidy and deeply coordinate the potential relationships between the attainment of energy and climate tasks, in order to simultaneously achieve the carbon peaking and non-fossil energy development pledges.

In closing, as for emissions control and non-fossil energy deployment, carbon tax and alternatives subsidy play rather different roles; specifically, the carbon tax policy performs much better in emissions mitigation, while the development of non-fossil technologies may affects more by the targeted subsidy. In fact, the attainment of carbon peaking pledge requires that the effect of carbon tax in the policy mix is many folds larger than that of subsidy, and the specific peaking time depends on both policy combination and the magnitude of peak values. As a contrast, the stronger the effect of alternatives subsidy in the mix policy, the larger the probability of achieving the committed carbon peaking goal will be. Consequently, in order to guarantee the achievement of the energy and climate pledges, it is rather important for the government to optimize the policy options when making related action strategies, especially for the multiple combinations of carbon taxes and alternatives subsidies.

## References


1. Jiang KJ, He CM, Zhuang X, et al (2016) Scenario and feasibility study for peaking $CO_2$ emissions from energy activities in China. Climate Change Research 12(3): 167-171.

2. Green F, Stern N (2016) China's changing economy: Implications for its carbon dioxide emissions. Climate Policy.

3. He JK (2013) Analysis of $CO_2$ emissions peak: China's objective and strategy. Chinese Journal of Population, Resource and Environment 23(12): 1-9.

4. Elzen MD, Fekete H, Höhne N, Annemiek A, Nicklas F, et al. (2016) Greenhouse gas emissions from current and enhanced policies of China until 2030: Can emissions peak before 2030?" Energy Policy 89: 224-236.

5. Tavoni M, Kriegler E, Riahi K, van Vuuren D, Tino Aboumahboub, et al. (2014) Post-2020 climate agreements in the major economies assessed in the light of global models. Nature Climate Change 5(2): 119-126.

6. Duan HB, Zhu L, Fan Y (2015) Modeling the evolutionary paths of multiple carbon-free energy technologies with policy incentives. Environmental Modeling & Assessment 20(1): 55-69.

7. Raupach MR, Davis SJ, Peters GP, Andrew RW, Josep GC, et al. (2014) Sharing a quota on cumulative carbon emissions. Nature Climate Change 4: 873-879.

8. Ding ZL, Duan XN, Ge QS, Zhang ZQ (2009) On the major proposals for carbon emission reduction and some related issues. Science in China Series D: Earth Science 39(12): 1659-1671.