TECHNOLOGY OPTIONS: CAN CHINA REACH ITS ELECTRIC POWER INDUSTRY CO_2 EMISSION PEAK BEFORE 2030？

Zongguo WEN, Tsinghua University, Phone +86 139 1155 3170, E-mail: wenzg@tsinghua.edu.cn
Xuan ZHANG, Tsinghua University, Phone +86 135 2020 2282, E-mail: mhqczhangxuan@126.com
Qilu TAN, Tsinghua University, Phone +86 139 0100 9245, E-mail: tql08@mails.tsinghua.edu.cn
Jining CHEN, Tsinghua University , Phone +86 18611010675, E-mail: jchen1@mail.tsinghua.edu.cn

Overview

As the first CO_2 emission country, China cannot reach the emission peak before 2030 by do nothing or just do little policy efforts. China faces a very tough situation of CO_2 mitigation under the pressure of international community. China would be in a more passive position in international negotiation due to the increase of total emission if impelling CO_2 emission control technologies and policies were not taken in time and as early as possible. As the first CO_2 emission country, China faces a very tough situation of reach its electric power industry CO_2 emission peak before 2030. Compared with history years 2005, 2010 and taken 2015, 2020, 2030 as targets years, this paper set up the low and high macro social development scenarios and the weak, middle, and supper technology mitigation scenarios in 2013.

The paper is organised as follows: After the introduction the second section gives a brief overview about the methodlogy, scenario settings and technology inventory. The third section addresses the CO_2 emission analysis, potential analysis and cost-benefit analysis. In section four we describe the results. In the final section techonlogy options are derived.

Methods

This paper uses the bottom-up thermal power industry GHG mitigation model and cost-benefit analysis (CBA). Ackerman F (2002) Many analytical approaches to setting environmental standards require some consideration of costs and benefits. Even technology based regulation, maligned by cost-benefit analysis. CBA can offer the adaptability to reduce emissions where it is most cost-effective Bosi M(2005) and it may be more feasible and manageable than a country-wide electricity sector approach Cai W(2007).The technology cost includes initial expenses, operating and maintenance cost, labor cost, replacement cost, etc. Benefit includes the private benefit resulted from facility operation, or in our case, from selling electricity. These data are relatively easy to get from current market data and past experience. In the carbon emission accounting model, the base is discharge coefficient method and correction bases are the material balance method, the fuel analysis method and measuring results, regardless the problem of full cycle emission.

Results

First, according to the analysis, in the social low control policy middle scenario (SL-CPM), China can reach its electric power industry CO_2 emission peak around 2030 with 4.6 billion tonnes CO_2-eq and the least reduce cost.

Second, in this 2030 peak scenario SL-CPM, China should reduce 1.78 billion tonnes CO_2-eq compare to the BAU in 2030. Which equals to the total CO2 emission of 300MW-1000MW coal-fired power plants with 5000 h in total 30 provinces and municipalities of China in 2013.

Third, to reach this 2030 peak, in 2020 and 2030, the Top 3 negative cost-beneficial technology options are 630℃or 700℃USC, Small Hydroelectricity and PWR II or III Nuclear power, which China government should promote first to reduce the horrible pollution and greenhouse gas emission.

Conclusions

In 2030, 700℃USC, Nuclear power Pressurized water reactor III (PWR III), Onshore wind power and NGCC will give the Top 4 emission potential. And the Top 4 cost-beneficial technology options are 700℃USC, Nuclear power Pressurized water reactor II and III and Small Hydroelectricity. But, for the cost decline uncertainty and technology innovation uncertainty, over dependence on new energy, nuclear power may cause energy supply insecurity and technology security risk, these are what China should pay more attention to in the next two decades.

References

Ackerman F (2002) Pricing the priceless: Cost-benefit analysis of environmental protection[J]. University of Pennsylvania Law Review, 1553-1584.

Bosi M (2005) Exploring options for " Sectoral crediting mechanisms". Organization for Economic Cooperation and Development (OECD)/International Energy Agency (IEA). Paper for the Annex One Experts Group on the UNFCCC, Paris, France

Cai W, W.C., Wang K (2007). Scenario analysis on CO2 emissions reduction potential in China's electricity sector. Energy Policy 35(12), 6445-6456.

Clarke L, E.J., Krey V (2009). International climate policy architectures: Overview of the EMF 22 International Scenarios. Energy Economics 31, S64-S81.

Coal Company.(2009). China clean coal strategy.

Ding Z (2009) Evaluation of international greenhouse gas emission reduction plan and China long-term emissions right discussion.. Chinese Science: D , 39(12): 1659-1671.

Hanak D P (2014) Heat integration and energy analysis for a supercritical high-ash coal-fired power plant integrated with a post-combustion carbon capture process[J]. Fuel

Lin B, Ouyang X. (2014) Energy demand in China: Comparison of characteristics between the US and China in rapid urbanization stage[J]. Energy Conversion and Management, 128-139.

Li Y P, Huang G H, Li M W. (2014) An integrated optimization modeling approach for planning emission trading and clean-energy development under uncertainty[J]. Renewable Energy,, 62: 31-46.

McElroy M B (2010) Challenge of global climate change: Prospects for a new energy paradigm[J]. Frontiers of Environmental Science & Engineering in China, 4(1): 2-11.

Nauclér T(2009) A. Pathways to a low-carbon economy: Version 2 of the global greenhouse gas abatement cost curve[J]. McKinsey & Company, 192.

NPC (2010). China's 12th Five-year Plan (2011-2015). National People's Congress.

Parvareh F, Sharma M, Qadir A(2014) Integration of solar energy in coal-fired power plants retrofitted with carbon capture: A review[J]. Renewable and Sustainable Energy Reviews, , 38: 1029-1044.

U.S. Government(2014) U.S.-China Joint Announcement on Climate Change, Office of Press Relations. ,Washington, DC, 12 November.

Wang Q (2014). Effects of urbanization on energy consumption in China[J]. Energy Policy, 2014, 65: 332-339.

Wang, Z.(2009). Electric power industry on how to deal with climate change. China power enterprise management, 3.

Wen Z, Zhang X, Chen J.(2014) Forecasting CO2 Mitigation and Policy Options for China's Key Sectors in 2010-2030. Energy & Environment, 25(3-4), 635-659.

Wu L Y, Zeng W H, Wu H. (2014) Energy Saving and Emission Reduction Potential Analysis Based on Industrial Structure and Scientific Technology Progress in China[J]. Advanced Materials Research, 827: 417-421.

Yuan J (2014) China's 2020 clean energy target: Consistency, pathways and policy implications[J]. Energy Policy, 65: 692-700.

Zhou W (2010). Chinese carbon emissions: International Comparison and mitigation strategies. Resources Science, 32(8).