

# Regional Environmental Impacts Of The Explosive Growth Of Wind Power

Qiang Wang<sup>1,2</sup>, Song Chen<sup>1</sup>, Jianren Fan<sup>1,2</sup>

<sup>1</sup> State Key Laboratory of Clean Energy Utilization/Zhejiang University, 38 Zheda Road, Hangzhou, P.R. China

<sup>2</sup> Zhejiang Key Laboratory of Clean Energy and Carbon Neutrality, 38 Zheda Road, Hangzhou, P.R. China  
zjuqw@zju.edu.cn; ch\_song@163.com; fanjr@zju.edu.cn

## Extended Abstract

As wind farm explosively develops worldwide, the interactions between wind farms and the environment attract increasing attention [1, 2]. Wind farms would alter the atmosphere by lifting surface roughness [3], extracting momentum and adding extra turbulence, inducing wake [4] and even climate changes [5]. Local and regional changes of wind, temperature, and precipitation have been reported [1, 2, 6]. However, it remains unclear how wind farms influence air pollution. Here we first show that wind farms in China have significant regional impacts on both climate and air pollutants especially in summer, by using a dynamic numerical weather prediction and a multi-scale air quality model. We show that although wind power cannot produce additional emissions, it is able to redistribute air pollutants via affecting the atmospheric process. Chinese wind farms influence the mesoscale circulation in summer, which increases PM<sub>2.5</sub> in the Beijing-Tianjin-Hebei (BTH) megalopolis with a peak of 6.76  $\mu\text{g}\cdot\text{m}^{-3}$  and reduces PM<sub>2.5</sub> in the Yangtze River Delta (YRD) region with a peak reduction of 5.25  $\mu\text{g}\cdot\text{m}^{-3}$  in the recent years from 2015 to 2018. These numbers are equivalent to those obtained by about 1.5 years of dominant contributions from anthropogenic emission abatement to reduce the national annual mean PM<sub>2.5</sub> concentration. It indicates that the effects of investing over 2 billion US dollars per year by the central government to reduce PM<sub>2.5</sub> might be canceled out by the impacts from Chinese wind power in certain regions. These significant variations of climate and air pollution are of the same order as the interannual variabilities in BTH and YRD, which has never been reported. More dominant impacts can be expected in the future according to the roadmap 2050 of China National Energy Administration [7]. Urgent attention from the government and industry is required to comprehensively evaluate the roadmap so as to set up better policies for sustainable development.

## References

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