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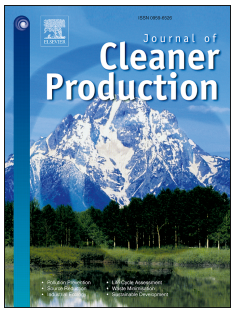

Multi-objective analysis of the co-mitigation of CO_2 and $PM_{2.5}$ pollution by China's iron and steel industry

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Multi-objective analysis of the co-mitigation of CO_2 and $PM_{2.5}$ pollution by China's iron and steel industry

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Abstract: China has experienced serious fine particulate matter ($PM_{2.5}$) pollution in recent years, and carbon dioxide (CO_2) emissions must be controlled so that China can keep its pledge to reduce CO_2 emissions by 2030. The iron and steel industry is energy intensive and contributes significantly to $PM_{2.5}$ pollution in China. The simultaneous reduction of CO_2 emissions and $PM_{2.5}$ pollution while minimizing the total mitigation costs remains a crucial issue that must be resolved. Using a multi-objective analysis, we compared potential technology combinations based on various policy preferences and targets. Our results showed that policies designed to mitigate $PM_{2.5}$ pollution have substantial co-benefits for CO_2 emissions reductions. However, policies focused solely on reducing CO_2 emissions fail to effectively reduce $PM_{2.5}$. Furthermore, CO_2 emissions reductions correspond to large financial costs, whereas $PM_{2.5}$ pollution reductions are less expensive. Our results suggest that under limited budgets, decision makers should prioritize $PM_{2.5}$ reductions because CO_2 reductions may be simultaneously achieved. Achieving large decreases in CO_2 emissions will require further technological innovations to reduce the cost threshold. Thus, China should focus on reducing PM pollution in the short term and prepare for the expected challenges associated with CO_2 reductions in the future.

Keywords: multi-objective, iron and steel, $PM_{2.5}$, CO_2 emission reduction, emission control, abatement cost

1. Introduction

Carbon dioxide (CO_2) is a major greenhouse gas (GHG) that has caused rapid increases in temperatures worldwide (Intergovernmental Panel on Climate Change, 2013). As a result of temperature increase, climate change is threatening the existence of human beings (Knutti et al., 2015). To deal with the climate change caused by CO_2 and other GHGs, the Paris Agreement was adopted at the 2015 United Nations Climate Change Conference. The dominant goal of the Paris Agreement is to hold "the increase in the global average temperature to well below 2 °C above preindustrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" (Rogelj et al., 2016). As the largest emitter of CO_2, accounting for 24% of