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Title: Coal mine methane in China: potential uses and benefits for both climate and air quality

Abstract: Coal mine methane (CMM), the methane gas produced or emitted in association with coal mining activities, is the largest source of anthropogenic methane emissions in China and a major cause of mine explosions and injury. In 2010, China's total CMM emissions accounted for 50% of the world's total, and 2433 people died in coal mining accidents. To tackle the problem of CMM emissions and coal mining accidents, China is seeking to capture 16 Tg methane per year as part of the Thirteenth Five Year Plan (2016-2020) for China's Natural Gas Development and use at least 7.1 Tg/yr for electricity or heat production. However, recent research indicates that China is falling short of its CMM targets under the Thirteenth Five-Year Plan, and this research brings new urgency to meeting these targets. In this study, we investigate the potential uses of CMM as a local fuel for electricity production or residential heating in several northern provinces. We evaluate the impacts of these uses on carbon emissions, regional air quality, and public health. Our emission scenarios explore the impacts of using CMM to generate electricity, displacing existing coal power plants, or using CMM for home heating in areas without centralized heating supply, displacing residential coal combustion. We find substantial decreases in carbon emissions in all scenarios; each scenario yields decreases of at least 5% in China's total carbon emissions (>700MtCO₂eq/yr). In addition, ambient PM_{2.5} concentrations across northern China decline by up to 10% (>11 µg/m³), and these reductions would lead to substantial decreases in associated premature mortalities.

Key words: