

Regional Differences in The Health and Environmental Benefits of Wind and Solar Energy: A Case Study of Vietnam

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ABSTRACT

Wind and solar energy provide health and environmental benefits as they reduce emissions of greenhouse gases such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) by replacing fossil-fuel power plants. Although it is intuitive to think regions with the best wind and solar resources would be most effective in emission displacement, this process also depends on the number and scale of conventional generators in each region. The current literature on the emissions implication of renewable energy has touched on the emission reduction of different technologies, the estimated emission savings, and the life cycle analysis of renewable energy. However, few studies have systematically compared a country's regional variations in emissions displacement from renewable energy, especially in a developing country where access to high-quality data is scarce. This paper aims to evaluate the effects of wind and solar energy on reducing emissions in the Northern, Central, and Southern regions of Vietnam. For instance, given its proximity to the coast and exposure to ample sunlight, Central Vietnam has significant potential for wind and solar energy. Yet, the health and environmental benefits of renewable energy may not be substantial in this region because the number of conventional generators here is much less than in Northern Vietnam. We compile the emission profiles of conventional generators from credible governmental sources, use regressions of hourly emissions and generation data to calculate the damages of marginal electricity production, and estimate the reduction in these damages when wind and solar energy replace conventional generators across three regions.

Keywords: emissions reduction; fossil-fuel power plants; regional variations; renewable energy; Vietnam