

## Environmental Policy Design, Innovation And Efficiency Gains In Electricity Generation

This paper explores the relationship between environmental regulation, innovation, and competitiveness, drawing upon a unique dataset on environmental regulations directed at combustion plants, a global dataset of power plants, and a global dataset of 'environmental' patents. The analysis is conducted in two stages. First, a nonparametric frontier analysis is implemented to estimate efficiency scores, including a measure of technological innovation based on patent stocks. Second, econometric methods are applied to analyse the role of policy stringency and policy design on efficiency. Our estimation sample covers thermal power plant sectors in 20 countries from 1990 to 2009. The results show that the stringency of environmental regulations is a significant determinant of productive efficiency with respect to pollutant emissions as well as fuel use. However, these effects turn negative once the level of stringency leaps over a certain threshold. In addition, the paper concludes that the positive effect of regulatory stringency can be diminished by a negative effect of regulatory differentiation with measures which are differentiated across plant size and age having negative consequences, and these effects are increasing over time. This finding is important given the prevalence of size- and vintage-differentiated policies in many countries. Finally, it is found that integrated approaches to environmental innovation are more likely to bring about efficiency improvements than end-of-pipe technologies.

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