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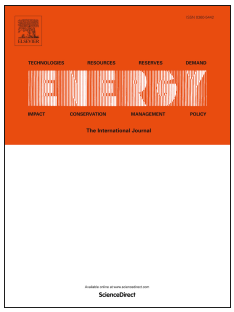

Market regulation and environmental productivity changes in the electricity and gas sector of 13 observed EU countries

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Abstract

The paper explores the way the environmental technical efficiency and productivity in the electricity and gas sectors of 13 EU countries have changed under the energy market reorganisation fostered by the EU energy reforms between 1995 and 2013. Using a multiple output distance function approach, we find that regulation encouraging privatisation and removing barriers to entry into the market had positive consequences on both environmental technical efficiency and the growth of environmental productivity. We find that the sector has made significant steps in improving its competitiveness and environmental sustainability, showing an annual average potential of 5.9% value-added gains and 5.6% CO_2 emissions reductions. However, the improvements in environmental performance differ greatly across countries and, at times, comes at the expense of economic benefit whereas environmental productivity change(3.2%) growing slower than the productivity change that does not account for emissions. Regarding improvements in environmental productivity, the main source came from environmental technical change (2.4–2.8%), underlying the role of research and development on energy transition.

Keywords: *electricity and gas market, market reforms, environmental* technical *efficiency, stochastic frontier analysis, environmental productivity change*

Highlights

- *The energy sector could realise 5–6% value-added gains and CO_2 emissions reduction.*
- *Technical change was the main source of environmental productivity improvements.*
- *Market reforms had a positive effect on environmental* technical *efficiency.*

1. Introduction

Market efficiency and the environmental implications of energy consumption have become crucial in the debate on the design of energy markets. The EU climate agenda has entered in force interacting with both economic and energy plans [1, 2, 3, 4]. From 2015, the Paris Agreement intensified European efforts for green competitiveness and Intended Nationally Determined Contributions (INDC) for greenhouse emissions reduction have been defined as a common strategy for the 28 European countries. Efforts towards decarbonisation the energy sector manifested also under the umbrella of the "Clean Energy for All Europeans" program, initiative[1] that proposes, among others, legislative changes pertaining to energy efficiency, renewable energies or design of the electricity market [2]. The current narrative of the Energy

[1] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans