

Estimating the target-consistent carbon price for electricity

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David Newbery

Abstract

The target-consistent price of carbon for an electricity sector decarbonizing through massive variable renewable electricity (VRE) depends sensitively on the VRE penetration level, as the marginal curtailment of VRE rises rapidly beyond a certain level. This paper develops a simple linear model to illustrate the relation between the shadow carbon price (SPC) and VRE penetration and calibrates it for the island of Ireland's 2026 target VRE penetration of 55%. The SPC rises rapidly with increased VRE investment beyond a certain point, and can be used to direct mitigating investment in storage, interconnectors, and other flexibility options. The SPC for the final efficient portfolio will be the target-consistent carbon price for electricity that can help judge the appropriateness of the original target level of VRE penetration.

Keywords social cost of carbon, variable renewable electricity, marginal curtailment

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Contact
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dmgn@cam.ac.uk