

NUCLEAR OPERATIONS WITH A HIGH PENETRATION OF RENEWABLES: THE CASE OF FRANCE

Nicolas Astier*

Frank A. Wolak†

Abstract

This work aims at studying empirically the behavior of a power system with a high penetration of both nuclear and intermittent renewables (wind and solar). Specifically, our main objective is to explore whether technical constraints on nuclear operations bind more often as more renewable capacity gets installed and, if so, how quickly the occurrence of these constraints increases. Strategic responses will also be of great interest. We study the case of France, a country which, at the end of 2023, hosts about 61GW of nuclear, 23GW of wind and 19GW of solar. Preliminary results suggest that the increase in renewables may indeed be associated with more hours where the minimum output constraint of nuclear units binds. Further work will explore the robustness of these results to more engineering-grounded empirical strategies, and study other outcome variables such as ramping constraints or (planned/forced) outages.

Keywords: nuclear, renewables, operating constraints

*Paris School of Economics, Ecole des Ponts, Paris, France, nicolas.astier@psemail.eu.

†Program on Energy and Sustainable Development and Department of Economics, Stanford University, Stanford, CA 94305-6072, wolak@zia.stanford.edu.