

AGENT-BASED MODELLING OF PORT DECARBONIZATION UNDER CARBON PRICING AND ENERGY CONSTRAINTS

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Extended Abstract

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Abstract Summary

This paper develops an agent-based model of port decarbonization under carbon pricing and local energy constraints for the Nantes Saint-Nazaire industrial-port cluster over 2025-2050. The model represents eight industrial agents making decentralized decisions on activity, logistics, fuel switching, and investment under a common EU ETS and FuelEU trajectory. It combines a project lifecycle module, an energy balance solver with capacity rationing, and endogenous coordination dynamics shaped by bilateral synergies, institutional frictions, project spillovers, and macro shocks. Results show that a common carbon price path can generate sharply different outcomes depending on the ability of the cluster to activate low-carbon capacities and coordinate energy reallocation. By 2050, electricity becomes more attractive than gas on an effective cost basis, yet fuel switching remains blocked in business-as-usual trajectories when local supply projects are not activated and coordination remains weak. By contrast, Strategic Autonomy and Collaborative Transformation unlock greater electrification and hydrogen uptake, producing much lower emissions while preserving maritime throughput. The paper argues that carbon pricing is necessary but not sufficient in industrial port clusters. Decarbonization also depends on infrastructure availability, energy constraints, and the collective capacity to reduce transaction costs and coordinate investment. The results contribute to energy economics by showing how price signals, physical constraints, and institutional dynamics jointly shape transition pathways in industrial-port systems.

Presenting Author Biography

Gabriel Blouet is a doctoral researcher at Nantes University. His work focuses on the decarbonization of industrial-port clusters, with particular attention to carbon pricing, energy constraints, and coordination dynamics. His research combines energy economics, territorial analysis, and agent-based modelling, using the Nantes Saint-Nazaire port cluster as an empirical case.