The Role of Technologies in Mitigating Climate Change: Resource Extraction in the Presence of a Backstop Technology and Carbon Dioxide Removal

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Abstract

This paper analyzes the role of carbon dioxide removal (CDR) and backstop technologies in transitioning to net-zero greenhouse gas emissions. We use a dynamic optimization approach with three carbon stocks – the resource stock, the atmospheric carbon stock, and carbon storage – to analyze the effect of temporary CDR in the presence of a backstop technology on resource consumption. Additionally, we consider multiple renewable atmospheric carbon stocks that decay at different rates. We find that when the resource is abundant and the CO_2 stock in the atmosphere is low enough, the resource alone is used. This is followed by a phase of simultaneous use of the resource and the backstop. Meanwhile, the use of CDR increases rapidly during the in the first years and then converges to a pumping equilibrium in the steady state. The calibration reveals that the backstop plays a more important role in decarbonization than CDR. In a steady state, non-renewable resources are no longer extracted, and the backstop technology fully meets demand.