

Renewable energy implementation and fossil stock development

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We explore the characteristics of the energy transition while explicitly considering the presence of previously developed stocks of fossil reserves, new fossil exploration and development and realistic constraints on fossil resource extraction. We identify two distinct renewable cost thresholds that separate the type of phase-out regimes. A fossil phase-out is optimal only if, at the margin, the total cost of a renewable substitute lies below the sum of costs associated with the exploration, extraction and use of one unit of fossil energy, including any taxes on fossil use. This phase-out will additionally feature abandonment of developed fossil reserves (i.e., developed stocks are left unextracted) if the renewable cost is below the use cost only. Current exploration of fossil resources need not be incompatible with an eventual phase-out, even if this phase-out involves abandoning reserves. Yet, any binding restriction on exploration will strictly increase the return to renewable investment. Finally, we consider the optimal implementation of a carbon budget. A binding carbon budget is incompatible with sustained extraction of fossil fuels, and will involve abandoning developed reserves.