

The technological and environmental efficiency of the EU-27 power mix: An evaluation based on MPT

Abstract:

Portfolio Theory can result in a valid and contrasted methodology for evaluating real assets and electricity production portfolios within the construct of energy planning. It results in a more complete alternative to the least-cost perspective. In the proposed model the production costs of all technologies are considered, including the different components of externalities (not only CO₂ costs). This tries to correct for possible market failure, due to imperfect cost allocation. Furthermore, the model measurement of technological risk is based on the non-weighted addition of variances. This proposal can be a more robust calculation to obtain risk values. The model presents a risk minimisation objective function and a cost–risk efficient frontier. Two different cases are proposed: “Pure Markowitz” (with only simple portfolio approach constraints) and “Technological Limitation” (considering the participation portfolio limits for technologies). It makes it possible to analyse the efficiency of IEA.EU-27 portfolios for year 2010 and 2020 and 2030 horizons from a Portfolio Theory perspective. The results are shown in terms of proximity to the Efficient Frontier and demonstrate how the “efficient minimum risk path” (economical and environmental) for EU-27 is essentially based on an increasing share of renewable sources in the power generation portfolio.