

“Evaluating the Reliability of Efficient Energy Technology Portfolios”
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Abstract

This paper develops a decision evaluation framework to assess how the treatment of risk affects the reliability of, and investment into, electricity generation infrastructure. First, portfolios of electricity generation technologies that comprise the energy supply systems in the US are evaluated using a mean-variance approach. Second, this research assesses the reliability of the portfolios with the aid of loss of load expectation and loss of energy expectation metrics.

The methodology considers the least-cost technology mix coupled with the reduction of market and system risks. The variation in the portfolio cost is based on the prevailing policies in the geographic locations. Overall, the current mix of technologies evaluated along the cost-risk latitudes shows an inefficient electricity technology portfolio system. First, investments in renewable technologies may create a bifurcation.

On the one hand, the portfolios with significant proportions of the high-cost intermittent technologies exhibit low market risks. On the other hand, these portfolios have less desirable system reliability measures. Second, policy makers will find it instructive that a more diverse electricity technology mix offers the potential to migrate to the efficient frontier in the near term.

However, it is imperative to craft policies in support of the transition with the caveat that technology diversity is not always a panacea for improving system reliability even if the portfolio is on the efficient frontier. This work projects some intriguing insights and offers guidance for policy makers.