

Investment Risk Mitigation and Cost-Benefit Analysis of DOD's Energy Technology Deployments – sponsored by the U.S. Department of Defense/MIT Lincoln Laboratory

This research explores a methodology for assessing the impact of component-level energy technology investments for the Department of Defense (DoD) under conditions of uncertainty by accounting for the cost of electricity, generation variations, financial risks, and facility locations across the United States (U.S.). This study applies modern portfolio theory to determine how much and what type of generation technologies the DoD should invest in to secure the supply of electricity to multiple facilities in the U.S. By focusing on developing multi-technology generation portfolio sets, this research investigates the technology options that will mitigate the overall energy system risk while saving on electricity generation investment costs. A significant outcome of this study is that having a more diversified electricity mix will provide reliable, secure, and affordable supply of electricity across military facilities. Specifically, the results show that mitigating portfolio risk may increase system cost. The inclusion of renewable energy technologies within predefined capacity upper and lower bounds may lead to more costly and riskier efficient frontiers. Along state lines, the results project significant portfolio differences in terms of technology choices and capacities. This outcome is intriguing because the result is consistent even amongst states with similar environmental and technology operation risks. Some of the nuances can be attributed to the influence of regional renewable energy expectations, policies, and integration efforts. While states or regions with stringent sustainability targets require the deployment of more renewable energy technologies, there is an upscale in the downside in terms of higher performance risks. In summary, modern portfolio theory, just as it proposed for financial instruments, suggests energy technology risk mitigation requires a suite of technologies for risk diversification with the downside trade-off of cost implications.