

Solar Energy Portfolio Analysis: Creating a Framework for Analyzing Multiple Solar Energy Investments

This problem is centered on the application of the Modern Portfolio Theory (MPT) in finance to renewable energy investments, specifically to solar energy. When an entity invests in multiple solar energy projects, each project can be seen as an asset in a diversified portfolio. Thus, the valuation of the entire portfolio requires an in-depth understanding of the interaction between individual assets. Such an approach can enable accurate valuation of renewable energy investments, and also help address the intermittency issues that affect these investments. If it can be shown that multiple renewable energy investments (e.g., solar, wind, hydro, geothermal, etc.) can provide a relatively predictable output over a given geographical region, then electricity systems operators may be willing to integrate more renewable energy into existing grids.

In order to keep this effort manageable, the focus will be on solar energy only. The financial returns from a solar energy investment are affected by multiple factors such as the fluctuation of solar radiation over time, the price of electricity sold to the grid, and the cost of financing. By creating a simple energy model, one can determine the input/output relationship between the incoming solar radiation and the resulting electricity generation. Additional assumptions can be made to simplify the problem, such as assuming a fixed price for selling the electricity. Using historical solar radiation data, the fluctuations in solar radiation can be modelled using statistical methods (e.g., bootstrap simulation). Once the “watts to dollars” conversion can be made for an individual solar investment, we can start modelling the entire portfolio.

By reviewing portfolio analysis methods in finance and adapting them to solar energy investments, the behaviour of the entire solar portfolio can be analyzed. Risk diversification effects, the marginal benefit of each additional asset, and the feasibility of adding other renewable energy sources to the mix can be assessed.

To support the creative problem solving process, our company will provide access to the relevant literature as well as hourly solar radiation data sets for different provinces in Canada. We will also help build a simple solar energy model so that the researchers can focus on the portfolio aspects of the problem.