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Marco A. Jano-Ito, Douglas Crawford-Brown

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Investment decisions considering economic, environmental and social factors: An actors' perspective for the electricity sector of Mexico

Marco A. Jano-Ito^{a,*} and Douglas Crawford-Brown^a

^a Cambridge Centre for Climate Change Mitigation Research (4CMR), Department of Land Economy, University of Cambridge, 19 Silver St, Cambridge CB3 9EP, United Kingdom.

* Corresponding author

Tel: +44(0)7931018098. E-mail address: maj52@cam.ac.uk

Abstract

The complex environment for planning created by liberalised electricity sectors, requires the use of frameworks that incorporate the multiple-objective nature of investment and also the behavioural aspect of decision-making. Such framework could aid company managers to select economically efficient, low carbon and socially accepted energy portfolios given their risk-taking levels. The work presented in this paper was aimed at bringing together decision analysis tools that have traditionally been used separately, and showing its usefulness in the context of the Mexican electricity sector. In order to accomplish this, a novel approach for the combination of multi-attribute utility theory (MAUT) and mean-variance portfolio (MVP) theory was established; and multi-attribute portfolios were determined with the aid of real data obtained through interviews and multi-objective optimisation. It was found that when only using MAUT, geothermal energy was favoured. The consideration of risk-aversion in portfolio optimisation highlighted natural gas combined cycles (NGCC) as the highest return option and the attractiveness of wind as an alternative to reduce fossil fuel risk. The extension to multiple attributes presented portfolios with a high share of low-carbon technologies that were not found when only one variable was considered.

Keywords

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