

# Investments in Wind Farms Considering Uncertainty in Wind Resource Assessments: A Real Options Approach

Eduardo A. Martínez Ceseña

Eduardo.Martinez-Cesena@postgrad.manchester.ac.uk

cesenia@hotmail.com

# Contents

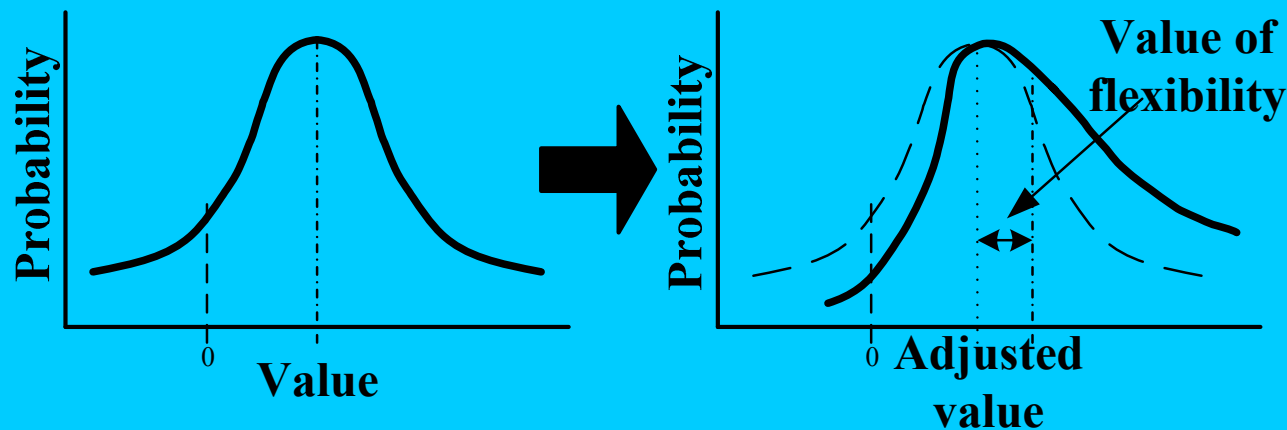
Introduction	3
Real Options theory	4
Wind power projects planning	6
Proposed methodology	9
Case study	10
Conclusion	11

# Introduction

- The success of wind power projects (WPPs) partially depends on the availability of support schemes.
- This dependency can be reduced by applying improved Real Options (ROs) theory for the planning and design of WPPs.

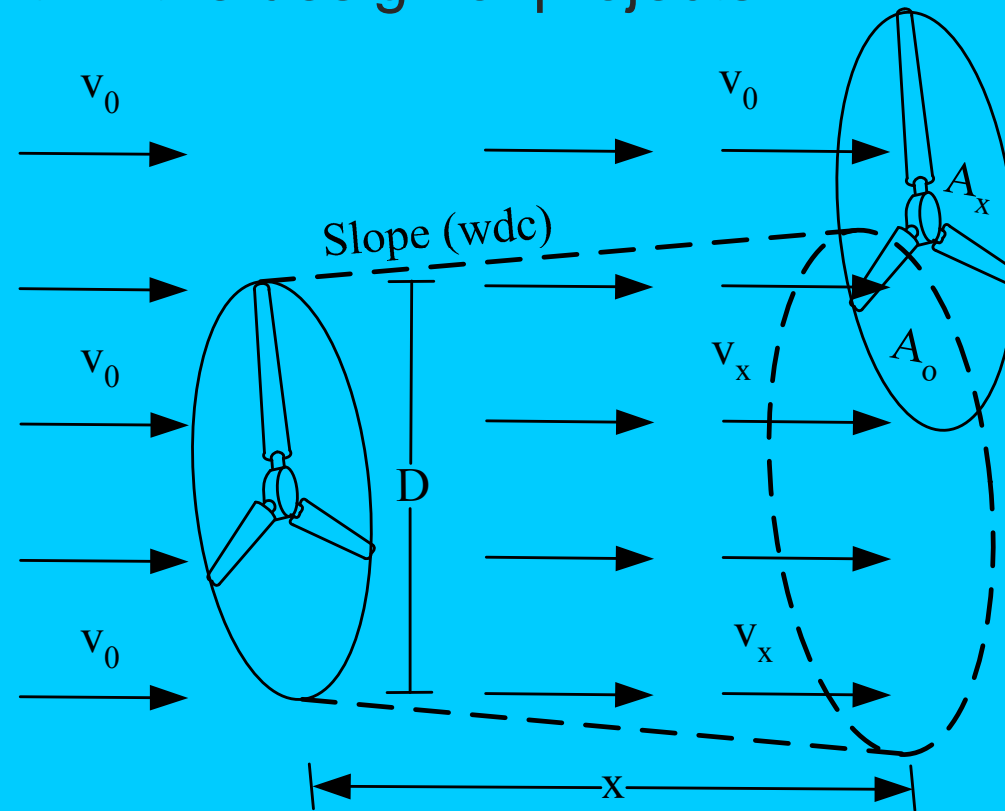
# Real Options theory

- Real Options theory is the application of financial options theory to projects concerning real assets.
- ROs provide flexibility to adjust projects in response to the evolution of uncertainty. As a result, the risks of projects decrease and their values increase.



# Real Options theory

- Real Options literature needs to be extended to address options within the design of projects.

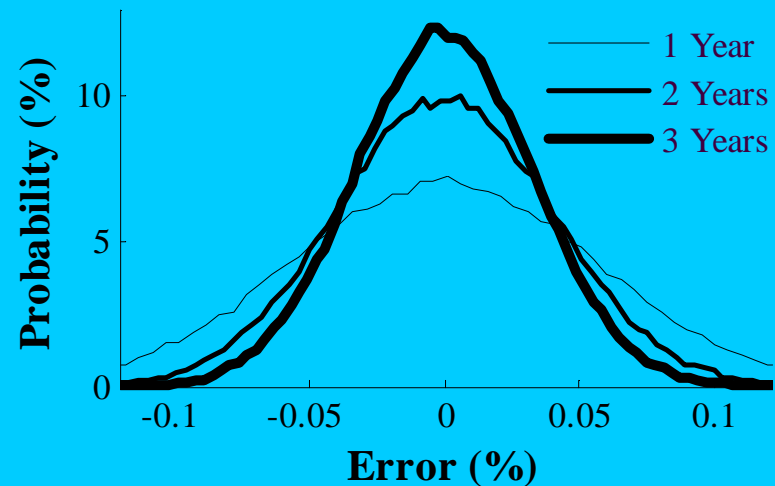
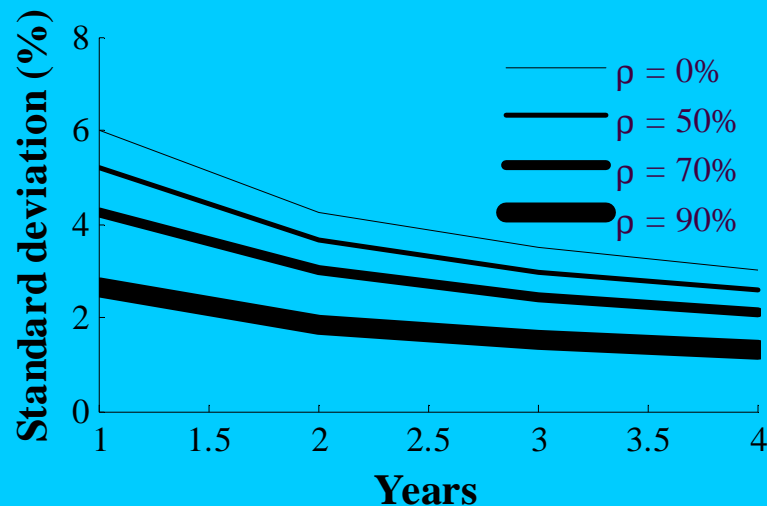


# Wind power projects planning

- The financial viability and optimal design of wind power projects is significantly influenced by the wind resource.
- Wind resource assessments (WRAs) estimate the available wind resource at specific sites. Nevertheless, the outcome of the WRA is uncertain.

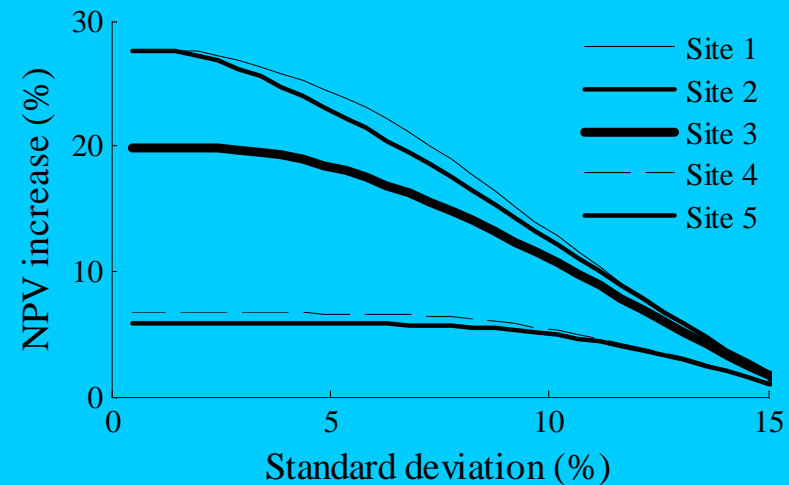
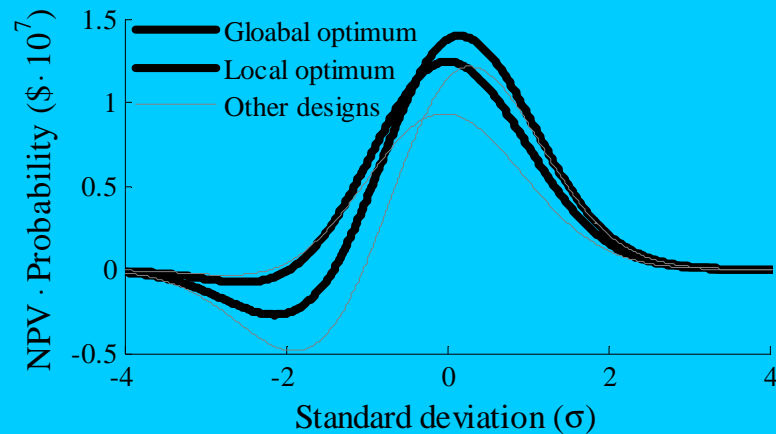
# Wind power projects planning

- The uncertainty associated to the WRA is affected by the techniques used to assess the wind resource, available on-site and reference data, and the characteristics of the site.



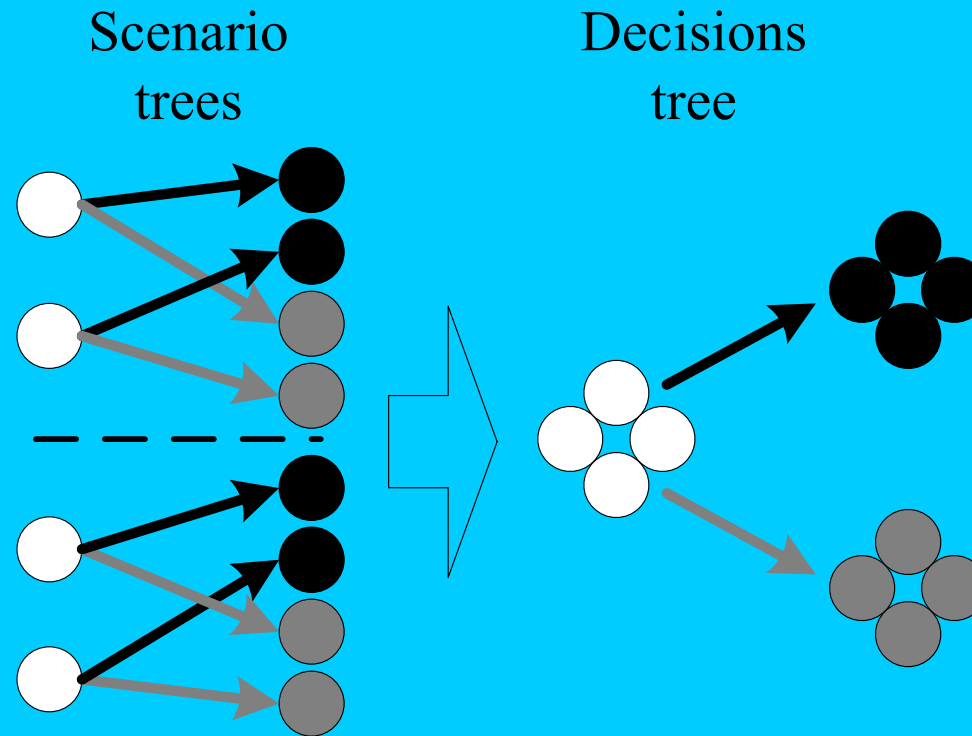
# Wind power projects planning

- Wind speed uncertainty and stochasticity can affect the optimal design of wind power projects.



# Proposed methodology

- ROs to postpone investment decisions in WPPs are assessed using linked path-dependant scenario trees.



# Case study

- The proposed methodology is tested with several case studies comprising six sites, 53 turbine models and 729 combinations of input parameters.
- The accuracy of the methodology and the value of a Real Option to postpone investment decisions is assessed for several scenarios.

# Conclusion

- The proposed methodology results in enhanced NPV for WPPs in most scenarios considered in this work.
- The performance of the methodology is case specific. It is affected by the wind resource, turbine characteristics, land lease costs, correlation, standard deviation, price of electricity, and discount factor.
- The results suggest that, in average, the methodology has an accuracy of 92% and enhances the NPV of WPPs by 1.25%.