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Modeling of a fully reneweable energy grid with hydrogen storage.

A stochastic approach considering time interdependence of wind and solar power.

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Abstract In recent years, the integration of renewable energy sources into electrical grids has become a critical area of research due to the increasing need for sustainable and resilient energy systems. In this article we present a comprehensive model for an electrical grid powered by wind and photovoltaic (PV) systems, supported by hydrogen storage. Firstly, we describe a scenario generation (SG) process for wind and photovoltaic (PV) power output, acknowledging the inherent dependencies between these variables over time. These dependencies are captured using marginal distributions coupled with a Gaussian copula, ensuring that the generated scenarios realistically reflect the temporal correlations observed in historical data. Further, we model the structure of a hypothetical electrical grid and develop an optimization process using a stochastic optimization approach to ensure robustness of the grid to the aforementioned variability. The third section validates the results from the second, checking feasibility over new scenarios. Some considerations follow on the computation of actual costs and the trade off between cost and robustness of the solution.

Keywords First keyword · Second keyword · More

Mathematics Subject Classification (2020) MSC code1 · MSC code2 · more

1 Introduction

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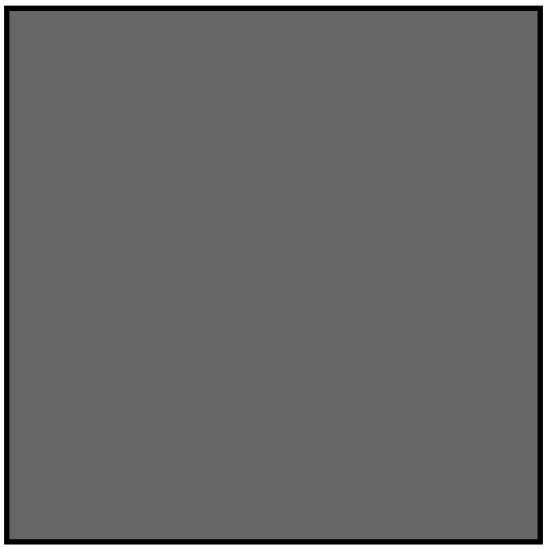

Fig. 1 Please write your figure caption here

Table 1 Please write your table caption here

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2 Section title

Text with citations [2] and [1].

2.1 Subsection title

as required. Don't forget to give each section and subsection a unique label (see Sect. 2).

Paragraph headings Use paragraph headings as needed.

$$a^2 + b^2 = c^2 \tag{1}$$

References

1. Author, Article title, Journal, Volume, page numbers (year)
2. Author, Book title, page numbers. Publisher, place (year)

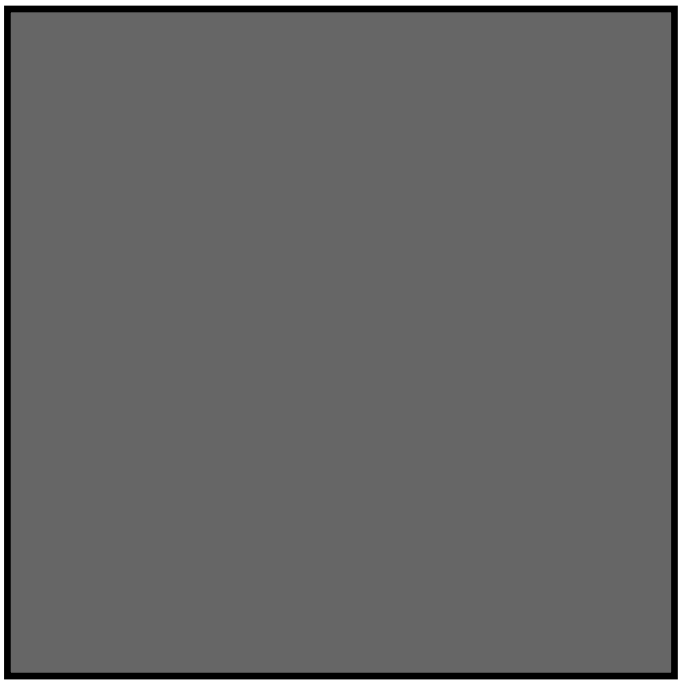

Fig. 2 Please write your figure caption here