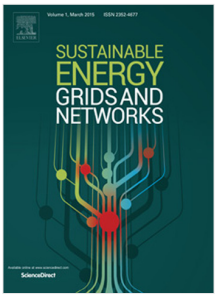
# Accepted Manuscript

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# Assessing the Contribution of Nightly Rechargeable Grid-Scale Storage to Generation Capacity Adequacy

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**Abstract**

This paper is concerned with assessing the contribution of grid-scale storage to generation capacity adequacy. Results are obtained for a utility-scale exemplar involving the Great Britain power system. All stores are assumed, for the purpose of capacity adequacy assessment, to be centrally controlled by the system operator, with the objective of minimising the Expected Energy Not Served over the peak demand season. The investigation is limited to stores that are sufficiently small such that discharge on one day does not restrict their ability to support adequacy on subsequent days. We argue that for such stores, the central control assumption does not imply loss of generality for the results.

Since it may be the case that stores must take power export decisions without the benefit of complete information about the state of the system, a methodology is presented for calculating bounds on the value of such information for supporting generation adequacy. A greedy strategy is proven to be optimal for the case where decisions can be made immediately after a generation shortfall event has occurred, regardless of the decision maker's risk aversion. The adequacy contribution of multiple stores is examined, and algorithms for coordinating their responses are presented.

*Keywords:* Storage, Generation Adequacy, Optimal Strategies, Coordination Algorithm

## 1. Introduction

The flexibility offered by grid-scale electrical energy storage plays a crucial role in lowering the cost of power delivered by future low carbon networks, whilst maintaining their reliability [1, 2, 3, 4]. For example, the International Electrotechnical Commission states in [3] that storage will become indispensable in emerging energy markets. The World Energy Council in [4] describes recent

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