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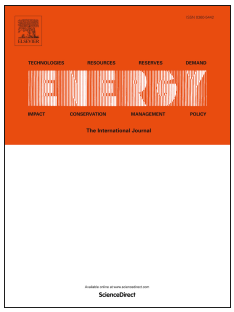

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Power ramp-rate control algorithm with optimal State of Charge reference via Dynamic Programming

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Abstract

This article presents a new control algorithm for an Intermittent Renewable Energy Systems coupled with an Energy Storage System (ESS) connected to a load and to the grid. It aims to limit grid power ramp-rate, to optimize energy trading and to manage the ESS State of Charge (SoC) under several constraints. The strategy uses a ramp-rate limiter algorithm with a SoC feedback control. The controller reference is optimized with a Dynamic Programming algorithm using weather and consumption predictions. Every two hours, the optimization is refreshed with the actual SoC and new predictions. The algorithm is applied on real data measured in Ajaccio and shows a light improvement in the plant operation cost and ensures that the ESS is not depleted at the end of the day.

Keywords: Ramp-rate control, Dynamic Programming, Optimization, Model Predictive Control, Power Management

2010 MSC: 00-01, 99-00

Introduction

With the increasing interest on renewable energy, partially autonomous micro-grids are developing. Their main objective is to produce a 'clean' energy –usually wind or solar– close to the consumers. Those micro-grids are connected to the main grid to buy or sell energy when the production is either insufficient or in excess. Distributed production is especially attractive in areas

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