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Energy, variability and weather finance engineering

Dimitrios Roussis, Iliana Parara, Panagiota Gournari, Yiannis Moustakis, Panayiotis Dimitriadis, Theano Iliopoulou, Demetris Koutsoyiannis, and Georgios Karakatsanis

Department of Water Resources and Environmental Engineering, School of Civil Engineering, National Technical University of Athens (NTUA)

Most types of renewable energies are characterized by intense intermittency, causing significant instabilities to the grid; further requiring additional infrastructure (e.g. pumped-storage) for buffering hydrometeorological uncertainties, as well as complex operational rules for load balancing. In addition, most intermittent renewable units are subsidized, creating significant market inefficiencies. Weather derivatives comprise mature financial tools for integrating successfully the intermittent-load and base-load components into a unified hybrid energy system and establish their operation within a generalized uncertainty management market. With a growing global market share and 46% utilization of this financial tool by the energy industry and 12% by agriculture (that partially concerns biofuel resources), weather derivatives are projected to constitute a critical subsystem of many grids for buffering frequent hydrometeorological risks of low and medium impacts –which are not covered by standard insurance contracts that aim exclusively at extreme events and high financial damages. In this context, we study the attributes of hydrometeorological time series in a remote and small island in Greece, powered by an autonomous hybrid energy system. Upon the results we choose the optimal underlying index and we further compose and engineer a weather derivative with features of a typical option contract –which we consider most flexible and appropriate for the case– to test our assumptions on its beneficiary effects for both the budget of private energy producers and the island's public administration.

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