Foreword to the Special Issue on Energy Finance and Climate Change

Roberto Baviera1 | Carlo Sgarra2 | Tiziano Vargiolu3 | Rituparna Sen4

https://doi.org/10.1002/asmb.2909

ABSTRACT

The current historical context has brought significant attention to energy finance and its relationship with climate change. This special issue presents several contributions addressing sustainability issues linked to climate change, which have important implications in the peculiar characteristics of energy markets.

This special issue is also connected to the EFI8 Conference on Energy Finance & Climate Change, held in memory of Peter Laurence (New York 1952–Rome 2013). Peterwas a pioneering figure in the field of energy finance in Italy, who strongly advocated for the development of the sector from both financial and mathematical perspectives. The conference brought together over 100 researchers, 46 presenters from 11 countries, 26 universities, and 9 leading companies operating in the sector, making it one of the key events in the European energy finance community during the first half of 2023.

FOREWORD

The contributions in this issue focus on three fundamental aspects of energy finance and its relationship with climate change: risk management and investment in the energy and weather sectors, electricity forecasting (both load and price), and optimization applications (in renewable energy communities and renewable source management).

The first theme explores the new risks and challenges in renewable energy investments, weather derivatives, and the design of

carbon allowance markets. Three contributions delve into this area. De Giovanni and Iakimova examine the effects of support schemes (e.g., Feed-in Tariffs or Green Certificates) and taxation on brown technology (e.g., Carbon Taxes or Carbon Permits) when investing in a portfolio of renewable energy sources.

Lempa and Benth focus on managing temperature-related risk exposure using temperature derivatives such as HDD and CDD index futures; they propose hedging strategies for different locations, cutoff temperatures, and time periods from those available in existing traded contracts. Rosemann and Sass highlight the role of emissions trading systems (ETS) in linking climate change policies with energy finance instruments. They specifically examine the importance of "banking" (i.e., transferring allowances to future years) in designing an effective emission allowance system.

The second theme addresses forecasting methodologies. Two key contributions focus on sustainability in this area: residential-scale load forecasting and multivariate price forecasting using copula techniques. Lu, Wang, Huang, and Wu introduce a new neural network model for short-term residential load forecasting, which is increasingly critical in modern smart grids due to the high volatility and uncertainty of load curves; their experimental results demonstrate the model's significant predictive performance improvements over existing benchmarks. Hirsch and Ziel focus on multivariate price forecasting for intraday power markets. They model the dependencies between different traded products and corresponding cross-product effects using copulas to account for the high-dimensional price return vector, with a focus on the German intraday electricity

market.

Finally, the issue includes two optimization applications addressing sustainability challenges. First, Di Girolami, Chevalier, Gaïgi, Giovannini, and Scotti tackle an optimal stochastic control problem for a dam, where power production operates under

Applied Stochastic Models in Business and Industry, 2024; 0:1–2 1 of 2
https://doi.org/10.1002/asmb.2909

uncertain electricity market prices and fluctuating water levels; they model this as a mixed control problem, incorporating regular and switching controls under constraints, and illustrate model's achievements through numerical examples. Second, Pacelli, De Blasis, and Vergine focus on cost optimization in a renewable energy community that uses shared photovoltaic and storage systems. Their analysis emphasizes the crucial role played by demand power characteristics and energy storage system size, both of which impact the benefits of an energy management scheme aimed at maximizing self-consumption of photovoltaic energy.

1Dipartimento di Matematica, Politecnico di Milano, Ringgold Standard Institution, Milano, Italy | 2Dipartimento di Matematica, Universita Degli Studi di Bari

Aldo Moro, Ringgold Standard Institution, Bari, Italy | 3Dipartimento di Matematica Tullio Levi-Civita, Universita Degli Studi di Padova, Ringgold Standard

Institution, Padova, Italy | 4Indian Statistical Institute, Kolkata, India