World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:19, No:04, 2025

Evaluating Forecasting Strategies for Day-Ahead Electricity Prices: Insights From the Russia-Ukraine Crisis

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Abstract : The liberalization of the energy market and the increasing penetration of fluctuating renewables (e.g., wind and solar power) have heightened the importance of the spot market for ensuring efficient electricity supply. This is further emphasized by the EU's goal of achieving net-zero emissions by 2050. The day-ahead market (DAM) plays a key role in European energy trading, accounting for 80-90% of spot transactions and providing critical insights for next-day pricing. Therefore, short-term electricity price forecasting (EPF) within the DAM is crucial for market participants to make informed decisions and improve their market positioning. Existing literature highlights out-of-sample performance as a key factor in assessing EPF accuracy, with influencing factors such as predictors, forecast horizon, model selection, and strategy. Several studies indicate that electricity demand is a primary price determinant, while renewable energy sources (RES) like wind and solar significantly impact price dynamics, often lowering prices. Additionally, incorporating data from neighboring countries, due to market coupling, further improves forecast accuracy. Most studies predict up to 24 steps ahead using hourly data, while some extend forecasts using higher-frequency data (e.g., half-hourly or quarter-hourly). Short-term EPF methods fall into two main categories: statistical and computational intelligence (CI) methods, with hybrid models combining both. While many studies use advanced statistical methods, particularly through different versions of traditional AR-type models, others apply computational techniques such as artificial neural networks (ANNs) and support vector machines (SVMs). Recent research combines multiple methods to enhance forecasting performance. Despite extensive research on EPF accuracy, a gap remains in understanding how forecasting strategy affects prediction outcomes. While iterated strategies are commonly used, they are often chosen without justification. This paper contributes by examining whether the choice of forecasting strategy impacts the quality of day-ahead price predictions, especially for multi-step forecasts. We evaluate both iterated and direct methods, exploring alternative ways of conducting iterated forecasts on benchmark and state-of-the-art forecasting frameworks. The goal is to assess whether these factors should be considered by end-users to improve forecast quality. We focus on the Greek DAM using data from July 1, 2021, to March 31, 2022. This period is chosen due to significant price volatility in Greece, driven by its dependence on natural gas and limited interconnection capacity with larger European grids. The analysis covers two phases: pre-conflict (January 1, 2022, to February 23, 2022) and post-conflict (February 24, 2022, to March 31, 2022), following the Russian-Ukraine conflict that initiated an energy crisis. We use the mean absolute percentage error (MAPE) and symmetric mean absolute percentage error (sMAPE) for evaluation, as well as the Direction of Change (DoC) measure to assess the accuracy of price movement predictions. Our findings suggest that forecasters need to apply all strategies across different horizons and models. Different strategies may be required for different horizons to optimize both accuracy and directional predictions, ensuring more reliable forecasts.

Keywords : short-term electricity price forecast, forecast strategies, forecast horizons, recursive strategy, direct strategy
Conference Title : ICEEEP 2025 : International Conference on Energy Economics and Energy Policy
Conference Location : Athens, Greece
Conference Dates : April 03-04, 2025