Pavlov K.
Pavlova O.
Wołowiec T.
Slobodian S.
Tymchyshak A.
Vlasenko T.

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Abstract. This study com pares state-of-the-art architectures using real-world data from over 100,000 consumers to determine their practical viability for forecasting gas consumption under operational and regulatory conditions. Particular attention is paid to the impact of data quality, feature attribution, and model reliability on performance. The main use cases for natural gas con sumption forecasting are tariff setting by regulators and system balancing for suppliers and operators. The results showed that previous consumption is the dominant feature for all models, confirming their autoregressive origin and the high importance of historical data. Temperature and category were identified as supporting features. Improvised data consistently improved the performance of all models. Seq2SeqPlus showed high accuracy, TiDE was the most stable, and TFT offered flexibility and interpretability.

Keywords: natural gas consumption and demand forecasting; neural networks; Seq2Seq; TiDE; Temporal Fusion Transformer; regulatory restrictions; energy systems; tariff policy; capacity balancing and reservation; machine learning; long short-term memory; time series analysis; SHAP processing of missing data